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"Promotion of Knowledge of Materials of Engineering and Standardization of Specifications and Methods of Testing"

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Number 119 December, 1942

1943 Spring Meeting and Committee Week to be in Buffalo, Week of March 1

Committee Meetings All Week; Technical Sessions on Powder Metallurgy and on Paints for Civilian Defense

In deciding to hold the 1943 Spring Meeting of the Society and A.S.T.M. Committee Week in Buffalo in response to the cordial invitation extended by a group of Buffalo members, many of whom are very active in various phases of A.S.T.M. work, the position of Buffalo and its surrounding territory is recognized as a leading industrial center and is in line with the desire of the Executive Committee to have Spring Meetings and Committee Week in various industrial centers where there are reasonable concentrations of A.S.T.M. members.

Two technical symposiums are planned as features of the Spring Meeting—one on powder metallurgy, the other on paints for civilian defense and related applications. Messrs. B. L. McCarthy, Chief Metallurgist, Wickwire Spencer Steel Co., and W. H. Lutz, Technical Director, Pratt & Lambert, Inc., have taken a leading part in arrangements for the meetings and each is laying the ground work for one of the symposiums, Mr. McCarthy the one on powder metallurgy, and Mr. Lutz the one on paints. Supporting them in various phases of the work are many other active members of the Society.

The Hotel Statler has been selected as the headquarters hotel and the technical and committee meetings will be held there.

Buffalo

It is planned to include condensed notes on historical and industrial aspects of Buffalo in the January ASTM Bulletin, in which will appear also further details of the technical program. Meanwhile, it is of interest to record that this city, the fourteenth in size in the United States, had in 1940 a population of some 576,000. The first records of the site of Buffalo apparently were dated about 1764, but it was not until about 1784 that the first permanent white settlers established homes there. Situated at the junction of the Niagara River and Lake Erie the city's advantages as a navigation center boomed particularly after the opening of the first Erie Canal in 1825.

Two presidents of the United States came from Buffalo—Millard Fillmore and Grover Cleveland. The Hotel Statler, which will be A.S.T.M. Buffalo headquarters, stands on the site of President Fillmore's former home.

In addition to important ferrous and non-ferrous metals plants, Buffalo is an important center for the manufacturer of various chemical products; including plastics, varnish, paint and lacquer; optical products; aircraft and airplane engines; and many other important materials and products. Leading industrial establishments are located in neighboring communities of Niagara Falls, Tonawanda, Lockport, Batavia, etc.

Local Committee on Arrangements

Under the chairmanship of B. L. McCarthy, a Committee on Arrangements for the 1943 Spring Meeting and Committee Week has been appointed with the following personnel:

Chairman: B. L. McCarthy, Chief Metallurgist, Wickwire Spencer Steel Co.
Vice-Chairman: W. H. Lutz, Technical Director, Pratt & Lambert, Inc.
Secretary: T. L. Mayer, Head, Department of Technology, Buffalo Public Library
J. F. Barton, Chief Chemist, The Federal Portland Cement Co., Inc.
T. J. Brown, Chairman, Department of Chemistry, Canisius College
A. W. Burwell, Vice-President and Technical Director, Alox Corp.
H. B. Chambers, Metallurgical Engineer, Canadian Atlas Steels, Ltd.
George Comstock, Metallurgist, The Titanium Alloy Mfg. Corp.
D. D. Crandall, Director of Research, National Gypsum Co.
H. J. Cutler, Engineer of Tests, Lackawanna, Bethlehem Steel Co., Inc.
J. R. Dawson, Metallurgist, Research Laboratories, Union Carbide and Carbon Co.
G. S. Hallenbeck, President, Hallenbeck Inspection and Testing Laboratory
L. F. Hoyt, Research Chemist, National Aniline Division, Allied Chemical and Dye Corp.

For a complete list of Emergency Specifications and Emergency Alternate Provisions ("pink slips"), see pages 55 and 56.

Hotel Statler on Left; Part of Niagara Square on Which Is the Civic Center

A. F. Knight, General Superintendent, Cosmos Imperial Mills, Ltd.
Fred Loosley, Metallurgist, Dominion Foundries and Steel, Ltd.
Alden Merrill, Technical Supervisor, The American Brass Co.
J. G. Morrow, Metallurgical Engineer, The Steel Company of Canada
O. M. O'Neill, Chief Chemist, Niagara Alkali Co.
F. A. Porter, Doehler Die Casting Co.
W. H. Rother, Metallurgist, Buffalo Foundry and Machine Co.
Alexander Schwarcman, Research Chemist, Spencer Kellogg and Sons
C. F. Smith, Jr., Rubber Technologist, U. S. Rubber Reclaiming Co.

The group has arranged subcommittees to be in charge of various aspects of the meeting, including the following:

Papers Committee: W. H. Lutz, *chairman;* T. J. Brown, George Comstock, Alden Merrill, O. M. O'Neill, H. R. Power, W. H. Rother.
Financial Committee: J. F. Barton, A. W. Burwell.
Dinner Committee: D. D. Crandall, *chairman;* H. J. Cutler, G. S. Hallenbeck, Alexander Schwarcman.
Invitations Committee: C. F. Smith, *chairman;* J. C. Fox, L. F. Hoyt.
Publicity Committee: T. L. Mayer, *chairman;* D. D. Crandall, G. S. Hallenbeck.

On the Buffalo Waterfront

Cuts courtesy of *Chemical Engineering News* American Chemical Society

Technical Program

After considering several important topics which might form the basis of technical papers or a symposium, or round-table discussions, the Papers Committee decided to arrange two symposiums—one featuring powder metallurgy, and the other, paints and the related newer materials of particular concern in civilian defense and related applications. The Buffalo group who are taking the initiative in the program work are having the close cooperation of A.S.T.M. Committee E-6 on Papers and Publications, with H. S. Rawdon, National Bureau of Standards, serving on Mr. McCarthy's powder metallurgy group, and Carlton H. Rose, National Lead Co., assisting Mr. Lutz with developments in the paint symposium. Also cooperating closely are the officers of Committee D-1 on Paint, Varnish, Lacquer, and Related Products—H. E. Smith, *chairman;* M. Rea Paul, *Secretary*. Tentative outlines of the programs which, of course, are subject to change almost up to the last minute, are as follows:

Symposium on Paint

Raw Materials

Summary of Commodities Picture—E. H. Bucy, WPB, Chief of Protective Coatings and Materials Section
Drying Oil and Fatty Acid Developments—Alexander Schwarcman, Research Chemist, Spencer Kellogg and Sons, Inc.
Surface Coating of Opaque Pigments—J. E. Booge (or representative), Technical Director, Krebs Pigment & Color Corp.
Surface Coating of Calcium Carbonate Extenders—E. W. Boughton, Manager, Paint Dept., R. T. Vanderbilt Co.

Miscellaneous

Water Emulsion Paints—Carl Iddings, Prescott Paint Co.

Civilian Defense Coatings

Concealment and Fire-Retardant Paints—J. J. Mattiello, Technical Director, Hilo Varnish Corp.
Blackout Paints—J. C. Moore, Superintendent, Paint Plant, Sinclair Refining Co.
Luminous Paints—G. F. A. Stutz, Chief of Pigment Research Division The New Jersey Zinc Co.

City Hall at Night

The committee in charge of the paint symposium may not plan to have formal papers prepared by various authors, but the session will rather take the form of a round-table discussion with designated authorities acting as leaders and presenting prepared discussion following which there will be questions and discussion from the audience.

Symposium on Powder Metallurgy

The following have accepted invitations to present papers as part of the Symposium on Powder Metallurgy: C. W. Balke, Director of Research Division I, Fansteel Metallurgical Co.; Charles Hardy (or representative), President, Hardy Metallurgical Co.; G. J. Comstock, Metal Powder Laboratory, Stevens Institute of Technology; and P. R. Kalischer, Chemical and Metallurgical Department, Westinghouse Electric and Manufacturing Co. The subjects of the papers will be announced in a later issue of the Bulletin.

A.S.T.M. Committee Week

As indicated, 1943 Committee Week will be held from Monday, March 1, through Friday, March 5. There is assurance that a number of the committees will have meetings at this time, in many cases with subcommittees meeting also. A list of committees which plan to convene will be included in the January Bulletin and each committee member will receive a notice well in advance of meetings of the respective groups with which he is affiliated.

Several of the larger A.S.T.M. committees have indicated they will participate, thus taking advantage of the presence at the meetings of many of their members who may be affiliated also with other groups. In fact, this is the chief purpose of these so-called group meetings—namely, of arranging sessions throughout the week so that the very active technical men who are members of different groups can with one trip cover various meetings. An exhaustive study is made by A.S.T.M. Headquarters to develop a schedule which will have as few conflicts as possible. Of course all conflicts cannot be avoided, but by adhering to the very rigid schedule these are kept to a minimum.

Hotel and Railroad Reservations

Members who have done any traveling recently do not need to be reminded to make railroad reservations as far in advance as possible and members also may wish to write promptly for hotel reservations. The Society has been assured of sufficient room accommodations to take care of the needs of members and a hotel reservation form will be mailed to members early in February. In addition to the headquarters hotel, The Statler, there are a number of other Buffalo hotels.

October 1942 List of Standards on Request

Any members of the Society or others concerned with A.S.T.M. specifications and tests can obtain on request copies of a 40-page List of A.S.T.M. Standards and Tentative Standards which under appropriate headings gives the titles and latest designations of the specifications. This list is effective as of late October, 1942. With the List of Standards is a four-page supplementary list of all A.S.T.M. emergency specifications and emergency alternate provisions. There will be no charge for the list and any reasonable number of extra copies will be sent.

While the List of Standards is used by A.S.T.M. Headquarters primarily in connection with inquiries, members may find it useful pending publication of the 1942 Index to Standards which will give latest references to publications where the Society standards appear. This Index is a combined index to all parts of the Books of Standards and a copy will be sent to each member and each purchaser of the 1942 Book of Standards sometime in late January or early February, 1943.

Several New Standards and Emergency Actions

Die Castings, Roofing Materials, Steel Inclusions, X-ray Diffraction

SINCE THE OCTOBER ASTM BULLETIN was issued, the Society's Committee E-10 on Standards has taken favorable action on several proposed new standards as recommended by various standing committees and in addition has approved a number of emergency items. Outlines of these standards matters are given below and in the case of the emergency alternate provisions these are published in the rear portion of the BULLETIN.

Die Castings:

Committee B-6 on Die-Cast Metals and Alloys has had a number of problems of an emergency nature and has issued certain emergency provisions. It has also been working for some time on requirements for copper-base (brass) alloy die castings which have been approved in the committee and by Committee E-10, carrying the A.S.T.M. designation B 176 – 42 T. The specifications as set up provide for two brass compositions—one, Alloy A, with copper 57.0 per cent min.; silicon, manganese, aluminum, iron, 0.25 max. each; maximum tin and lead of 1.50 per cent each; with zinc, 30.0 per cent min. Alloy B carries higher copper—63.0 to 67.0 per cent; silicon, 0.75 to 1.25, with zinc the remainder, after allowances for maximum lead and tin, and manganese, aluminum, iron. While acceptance, unless specified, is *not* to depend on physical properties, there are given typical properties which for Alloy A are 45,000 psi. min. tensile strength; 25,000 psi. yield point; and 10 per cent elongation; and for Alloy B, 58,000 psi., 30,000 psi., and 15 per cent, respectively.

The new specifications for Special Grade Zinc-Base Alloy Die Castings (B 186 – 42 T) apply for highly critical applications where added assurance will be gained against breakdown in service which might entail danger to life or failure to achieve important objectives. Alloy No. XXXIII is a 0.10 per cent max. copper; 3.75 to 4.25 per cent aluminum, with zinc remainder, and Alloy No. XXXV has copper of 0.75 to 1.25 per cent, aluminum, 3.75 to 4.25 per cent, with zinc remainder. Tensile strength min. for Alloy No. XXXIII is 35,000 psi. for average of specimens tested; 3 per cent elongation in 2 in., and Charpy impact, min. ft.-lb. of 12. Corresponding figures for Alloy No. XXXV are: 40,000 psi., 2 per cent, and 12 ft. lb.

Copies of each of these two specifications are available in separate pamphlet form at 25 cents each and they are also being issued to the members in Part I of the 1942 Book of Standards.

Waterproofing and Roofing Materials.—Through action of Committee D-8 on Bituminous Waterproofing and Roofing Materials a new specification covering asphalt siding surfaced with coarse mineral granules (D 699 – 42 T) has been approved. This material is in strip or individual form surfaced with colored mineral granules composed of roofing felt, saturated and coated on both sides with asphalt and surfaced on the weather side with granulated slate or equivalent mineral material (of solid or mixed colors as may be agreed upon by the purchaser and the seller), and on the reverse side with suitable material to prevent sticking in the package.

Revisions in two existing specifications were accepted—one in requirements for asphalt roofing surfaced with coarse mineral granules (D 249 – 42 T) involving a surface finish and lap cement, and the other in the Methods of Testing Asphalt Roll Roofing, Cap Sheets, and Shingles (D 228 – 42 T) where the modifications involve several sections.

X-ray Diffraction Methods; Inclusion Content of Steel.—For some time Committee E-4 on Metallography which is responsible for work in the field of X-ray diffraction has been working in close cooperation with leading physicists and other technical men to perfect a procedure for identifying crystalline materials by the Hanawalt X-ray diffraction method (E 43 – 42 T). The scope indicates that the basis for the method was laid by A. W. Hull, General Electric Co., and later additions and data were contributed by Hanawalt for whom the new method is named. The use of the method requires a knowledge of the interplanar spacings in the crystal corresponding to the three most intense lines in the X-ray diffraction pattern of each of the crystal components of the unknown specimen, and at least an approximate knowledge of the relative intensities of these lines. Such data have been compiled in card index form by joint action of the A.S.T.M. and the National Research Council, and are available for purchase through the A.S.T.M.

The other method, perfected by the committee after considerable work, covers procedure for determining the inclusion content of steel (E 45 – 42 T). In order to determine and for revealing inclusions some metallographic methods are required, since chemical determination is not sufficient. Methods which have been found useful are the longitudinal fracture test of heat-treated disks, a so-called "step-down" test, and a magnetic powder test. The new procedure covers in detail these various methods.

Revision of Methods of Preparing Metallographic Specimens.—Committee E-4 on Metallography has prepared a number of important and widely used standards, including Classification of Austenite Grain Size in Steels (E 19 – 39 T), requirements on Preparing Micrographs of Metals Including Practice for Photography as Applied to Metallography (E 2 – 39 T) and also has covered the Preparation of Metallographic Specimens (E 3 – 39 T) which is now being revised to cover the preparation of samples by electrolytic methods. These newer procedures have come into wide use. Electrolytic polishing is the preparation of smooth scratch-free surfaces by anodic corrosion in a fluid electrolyte. By correct adjustment of the composition of the electrolyte, temperature, voltage, current density, and time, the removal of material from a metallic surface in this way can be controlled so as to affect only the protruding portions, leaving an approximately plane surface with no greater irregularities than are produced by the more common mechanical methods of polishing.

EMERGENCY ALTERNATE PROVISIONS

Wheels for Electric Railway Service.—As indicated elsewhere in this BULLETIN, the Specifications for Wrought

Steel Wheels for Electric Railway Service (A 25 – 41) with emergency alternate EA – A 25a are now mandatory to cover all products of this material. The emergency provisions cover a requirement for sulfur in acid steel of 0.06 per cent instead of the previous requirement of 0.05 which now applies to the basic steel. The latest provisions also give requirements for spun steel wheels. Published with the provisions are tables of dimensions of standard steel wheel designs as developed by a special committee of the American Transit Engineering Assn. and reprinted by permission of that group. These tables represent a very extensive simplification effort. In this BULLETIN the tables of wheel designs are not duplicated, but the remainder of the emergency provision does appear on a later page of the BULLETIN. The emergency provisions are being furnished with Part I of the 1942 Book of Standards, and a copy of the "pink sheets" can be obtained by members on request.

With Students, A.S.T.M. Membership Is Over 5000

IN REPORTING that the A.S.T.M. membership is close to 4700, this figure does not include the A.S.T.M. student memberships at various colleges and universities. At this time there are about 540 student members scattered throughout some 40 colleges and universities in all parts of the country. Two schools merit particular mention—The College of the City of New York, and Ohio State University, with more than 100 student members each. A list of the ten schools with top student numbers follows:

College of the City of New York
Ohio State University
University of Delaware
University of New Mexico
Cornell University
Grove City College
University of Pennsylvania
Rensselaer Polytechnic Institute
Detroit Institute of Technology
University of Kansas

The Society is definitely interested in maintaining an active group of student members, and has in effect a very liberal publication policy: for their dues of $1.50 students get the ASTM BULLETIN, may request preprints of any technical papers and reports, may elect to secure on their membership any one of the special compilations of standards, ranging in list price from $1.35 to $2.50, or they may obtain the Selective Standards for Students in Engineering and receive the Index to Standards. Students may also purchase any part of the Book of Standards at considerably reduced price—lower than the cost of extra copies for members. This latter policy is responsible for heavy membership in certain schools where the Books of Standards are used as supplements to textbooks. There is also another factor which increases student memberships, namely, the practice of several A.S.T.M. members of sponsoring student membership prize awards in a number of leading schools, in many cases the *Alma Mater* of the donor. By this award, students are awarded a student membership as a prize for outstanding scholastic work in courses selected by the donor and some faculty member at the school, frequently a course involving testing laboratories. A list of the donors and colleges where awards are established follows:

T. G. Delbridge	Cornell University
F. O. Clements	Detroit Institute of Technology
A. E. Peterson	Gonzaga University
A. E. Pew, Jr.	Grove City College
A. E. Peterson	University of Idaho
S. H. Ingberg	University of Illinois
H. P. Bigler	Iowa State College
W. Bohnstengel	University of Kansas
C. L. Warwick	University of Pennsylvania
Herbert Spencer	Rensselaer Polytechnic Inst.
S. Collier	Worcester Polytechnic Inst.

The Society will be glad to send more detailed information on the prize award plan to any A.S.T.M. member or others who may be interested in establishing this plan at some engineering or technical school.

New Los Angeles Building Code

SOME 39 A.S.T.M. specifications and tests are referred to in the recently promulgated building code for the City of Los Angeles. This new code is the result of many years' accumulation of ordinances. The provisions of the new code have been carefully balanced to permit wide latitude of design within the limits of safety. In general, the desired results are specified and the builder is left free to choose his own methods of construction. The restrictions on the use of materials and methods have been made flexible to eliminate the establishment of legalized monopoly and to encourage the use of new construction methods. The reduced costs of building resulting from removing the restrictions on ingenuity should stimulate building activity.

The form and arrangement of the material in the proposed Los Angeles Building Code follow in a general way that of the Uniform Code* and the Los Angeles County Code. This scheme was adopted for the convenience of members of the construction industry who are called upon to use all three codes. The code is arranged in 29 separate divisions each of which covers a definite subject and, as far as possible, all the provisions relating to one subject are placed in one division of the code.

The division numbers do not follow consecutively in all cases because in some cases the material found in several divisions of the Uniform Code is condensed into one division of the proposed Los Angeles Code. The numbers of the missing divisions were omitted so that the same number applies to the same subject whether it be found in the Uniform Code, the Los Angeles County Code, or the Los Angeles Code. It is not intended that all the subject matter be identical in all three codes because the problems of Los Angeles City are unique and cannot be solved by using a general code which might be acceptable elsewhere.

The some 39 references to A.S.T.M. specifications and tests are in the divisions of the code which cover the following subjects:

Definitions	Screens	Refractories
Masonry Units	Reinforcement	Fire Tests of Building Materials
Lumber Grades	Ready-Mixed Concrete	Gypsum Lath
Cement	Steel and Iron	Portland Cement
Tests	Welding Electrodes	Gypsum Plaster
Aggregates	Pipe	

* Promulgated by the Pacific Coast Building Officials Conference.

Code Requirements for New Dwelling Construction

JUST RECEIVED is a Building Materials and Structures Report, BMS88, as issued by the National Bureau of Standards, this report covering recommended building code requirements for new dwelling construction. Essentially it is a report of the Subcommittee on Building Codes of the Central Housing Committee on Research, Design, and Construction. H. W. Peaslee is chairman of the committee, and a number of authorities in the field served including George N. Thompson as Technical Adviser, an A.S.T.M. member who is Chief of Building Codes Section, National Bureau of Standards, and Henry H. Waples, another A.S.T.M. member who is Architectural Engineer, Public Buildings Administration, Federal Works Agency.

An abstract of this report is as follows:

"A series of recommended requirements suitable for use in building codes is presented. These requirements apply to single- and two-family houses and to multiple dwellings of limited height. They cover such matters as fire resistance, light and ventilation, exits, strength of construction, and chimneys and fireplaces. In general, good practice is required, certain well-recognized standards and specifications being cited as acceptable evidence of good practice. Specific dimensions and other details are given where necessary. The report contains an appendix in which additional information is given, including methods of meeting specific code provisions and references to source material."

In a Foreword to the Code, Dr. Lyman J. Briggs, Director of the National Bureau of Standards, points out that:

"Building code requirements are frequently criticized on the ground that they call for excessive amounts of materials and discourage the introduction of new methods of construction. Such criticism is pointless unless improved requirements can be offered that will have the effect of correcting the conditions mentioned. In this report a representative committee, drawn from the Federal agencies most concerned with housing, presents its recommendations for such improved requirements. The intent is to assure safety and health and at the same time permit the greatest possible flexibility in design and construction."

A number of references are made to A.S.T.M. specifications and standards in the Code, the Section on Quality of Materials reading as follows:

"All building materials shall be of good quality, conforming to generally accepted standards. Except as may be otherwise provided in law, or in this Code, or in duly promulgated regulations, the specifications of the American Society for Testing Materials or other generally accepted standards—such as Federal Specifications, standards of the American Standards Association, or Commercial Standards promulgated by the United States Department of Commerce through the National Bureau of Standards—shall be deemed to be generally accepted standards."

In the Appendix to this report are much valuable data for those concerned with building construction—information on working stress for timber, on maximum spans for joists, rafters, etc., data on roof covering, and other subjects, such as noise, termites, etc.

Copies of the report can be obtained from the Superintendent of Documents, Washington, D. C., at 20 cents per copy.

Marine Engineering Regulations and Materials Specifications

A COPY OF "Marine Engineering Regulations and Material Specifications" as issued by the Commandant, U. S. Coast Guard, has just been received. This covers materials, construction, installation, inspection, and maintenance of boilers, unfired pressure vessels, appurtenances, piping, fusion welding, and brazing. The publication is dated February, 1942, and includes all material which passed up to February 28. With the material were certain Federal Register reprints giving additional engineering rules. This publication, which can be obtained from U. S. Coast Guard Headquarters, Washington, without cost, is of interest to many A.S.T.M. members concerned with marine work. Also it is of interest generally to members because of a number of references to A.S.T.M. specifications. In connection with the numerous metal specifications, the book indicates that they are "in substantial agreement with A.S.T.M. designations," these designations then being given. Such a reference is made in connection with the following items:

SHIPPING

CHAPTER I—BUREAU OF MARINE INSPECTION AND NAVIGATION

SUBCHAPTER F—MARINE ENGINEERING

Part 51—Materials

	Material	In Substantial Agreement with A.S.T.M. Designations:
51.2-1	Marine Boiler Steel Plate	A 201 – 39, A 212 – 39, and A 204 – 39
51.4-1	Staybolt Steel	A 31 – 40
51.6-1	Wrought-Iron Bars for Stays and Stay Bolts	A 84 – 39
51.7-1	Rivet Steel	A 31 – 40 and A 202 – 39
51.8-1	Rivet Iron	A 152 – 39
51.9-1	Lap-Welded and Seamless Steel and Lap-Welded Iron Boiler Tubes	A 83 – 40
51.9a-1	Electric-Resistance-Welded Steel and Open-Hearth Iron Boiler and Superheater Tubes	A 178 – 40 and A 226 – 40
51.10-1	Seamless Steel Boiler Tubes for High-Pressure Service; Medium-Carbon Seamless Steel Boiler and Superheater Tubes; Carbon-Molybdenum Alloy-Steel Boiler and Superheater Tubes	A 192 – 40, A 210 – 40, and A 209 – 41 T
51.11-1	Steel Pipe	A 106 – 41 and A 206 – 41 T
51.12-1	Welded Wrought Iron Pipe	A 72 – 39
51.13-1	Seamless Brass Pipe	B 43 – 41
51.14-1	Seamless Copper Pipe	B 42 – 41 T
51.15-1	Steel Forgings	A 105 – 40 and A 182 – 40
51.16-1	Alloy-Steel Bolting Material	A 96 – 39
51.16a-1	Carbon and Alloy-Steel Nuts for for High-Temperature Service	A 194 – 40
51.17-1	Steel Castings	A 95 – 41 and A 157 – 41
51.18-1	Gray Iron Castings for Valves, Flanges, and Pipe Fittings	A 126 – 40
51.19-1	Malleable Iron Castings	A 47 – 33
51.19-11	Malleable Iron Castings for Pipe Fittings	A 197 – 39
51.20-1	Bronze Castings	B 60 – 41, B 61 – 41, and B 62 – 41
51.21-1	Steel Plates (Flange and Firebox Quality)	A 70 – 39
51.22-1	Steel Plates for Welding (Flange and Firebox Quality)	A 89 – 39

Acid and Alkali Resistance of Plastics *

By John Delmonte[1]

MUCH QUALITATIVE data have been published upon the resistance of plastics to chemical reagents, in particular acids and alkalies. These experiments have been valuable in that they reveal those materials which are quite active in attacking plastic materials. A very complete report on the effect of chemical reagents was published in 1941.[2] Utilizing the A.S.T.M. Tentative Method of Test for Resistance of Plastics to Chemical Reagents (D 543 - 39 T)[3] the investigators reported upon numerous plastics which were immersed in various acid, alkalies, and solvents. The effects were noted as percentage changes in weight and dimension for a 7-day immersion period at 25 C. Further interesting data were revealed upon subsequent exposure to air at 77 F. and 50 per cent relative humidity.

METHOD OF TEST

In the current investigation a wide range of acid and alkali concentrations were employed, and a quantitative examination made of the effect upon plastic materials at various intervals. It was reasoned that if the acid or alkali attacked the plastic material, such an attack would be observed by a decrease in the physical properties of the material. This method of analysis, whereby the progress of chemical attack is noted by changes in the physical properties, is not new, having been employed in other investigations.[4,5,6]

It was felt that such tests should be performed at fairly frequent intervals during the first day and then every other day or so once the tests were under way. The punch-and-die method of test described in a recent issue of the ASTM BULLETIN[7] was employed, as this technique not only allowed a test to be performed within the space of a few seconds but also required only a small test specimen. Thus, for example, samples of plastic material $^1/_2$ in. wide, $2^1/_2$ in. long and about $^1/_{16}$ in. thick were employed. The punch was 0.104 in. in diameter and the die about 0.108 in. in diameter to avoid excessive stress concentrations at edges of the punch. Loads were measured with an arbor press and spring-loaded scale. The specimens were placed in the center of the punch and the lever arm pulled down by hand until failure was observed. Punch strength was calculated from the following formula:

$$S = \frac{P}{\pi \times 0.104 \times t}$$

where S = punch strength in pounds per square inch,
P = load in pounds to produce failure, and
t = thickness in inches.

However, the chief concern was *the change* which took place in the plastic after various immersion periods in the corrosive chemicals, rather than absolute values, and data are reported as percentage change from the original physical condition. Thus, when a plastic was completely disintegrated by the acid or alkali the percentage change would be 100 per cent.

CORROSIVE AGENTS

Acids selected for these tests were chemically pure nitric acid, sulfuric acid, and hydrochloric acid. Sodium hydroxide was employed as a representative alkali. Solutions of various normalities were prepared and their strength carefully checked by titrations against 0.1*N* standard hydrochloric acid and 0.1*N* standard sodium hydroxide solutions. Test specimens were placed in small corked 3-dram vials, which were filled with the acid or alkali being used.

MATERIALS TESTED

Included in this investigation were the following plastic materials:

1. Laminated phenolic plastic, paper base, grade XX, $^1/_{16}$ in. thick.
2. Cellulose nitrate, Celluloid Corp., 0.045 in. thick, black.
3. Cellulose acetate, Monsanto Chemical Co., $^1/_{16}$ in. thick, clear.
4. Polyvinyl chloride acetate, Carbide and Carbon Chemical Co., $^1/_{16}$ in. thick, cream color.
5. Polystyrene, A-200, Monsanto Chemical Co., $^1/_{16}$ in. thick.
6. Polymethyl methacrylate, Röhm & Haas Co., $^1/_{16}$ in. thick, clear.
7. Laminated phenolic, glass base, 0.055 in. thick.

The last sample was employed only in part of the tests, where it was necessary to determine whether the chemical attack was directed against the paper base or against the phenolic resin binder.

CONDITIONING

Since it was determined that conditioning influenced results, all specimens were placed in a drying oven at 50 C. for at least 48 hr. prior to test.

TEST RESULTS

The results of this investigation are shown in Figs. 1 to 4 and in some of the accompanying tabular data. First, referring to the illustrations, it will be noted that the ordinates represent percentage of original strength. It is more convenient to plot the data this way than to refer

NOTE.—DISCUSSION OF THIS PAPER IS INVITED, either for publication or for the attention of the author. Address all communications to A.S.T.M. Headquarters, 260 S. Broad St., Philadelphia, Pa.

* Presented at the Forty-fifth Annual Meeting, Am. Soc. Testing Mats., Atlantic City, N. J., June 22–26, 1942.

[1] Technical Director, Plastics Industries Technical Inst., Los Angeles, Calif.

[2] G. M. Kline, R. C. Rinker, and H. F. Meindl, "Resistance of Plastics to Chemical Reagents," *Proceedings*, Am. Soc. Testing Mats., Vol. 41, p. 1246 (1941).

[3] 1939 Book of A.S.T.M. Standards, Part III, p. 805.

[4] Sakurada-Watanabe, *Journal*, Soc. Chemical Industry (Japan), Vol. 39, Supplement 50, p. 1 (1936).

[5] S. Peierls, "Polyvinyl Alcohol Plastics," *Modern Plastics*, Vol. 18, February, 1941, p. 53.

[6] John Delmonte, "Effect of Solvents on Organic Plastics," *Industrial and Engineering Chemistry*, Vol. 34, June, 1942, p. 764.

[7] John Delmonte, "Shear Strength of Molded Plastic Materials," ASTM BULLETIN, No. 114, January, 1942, p. 25.

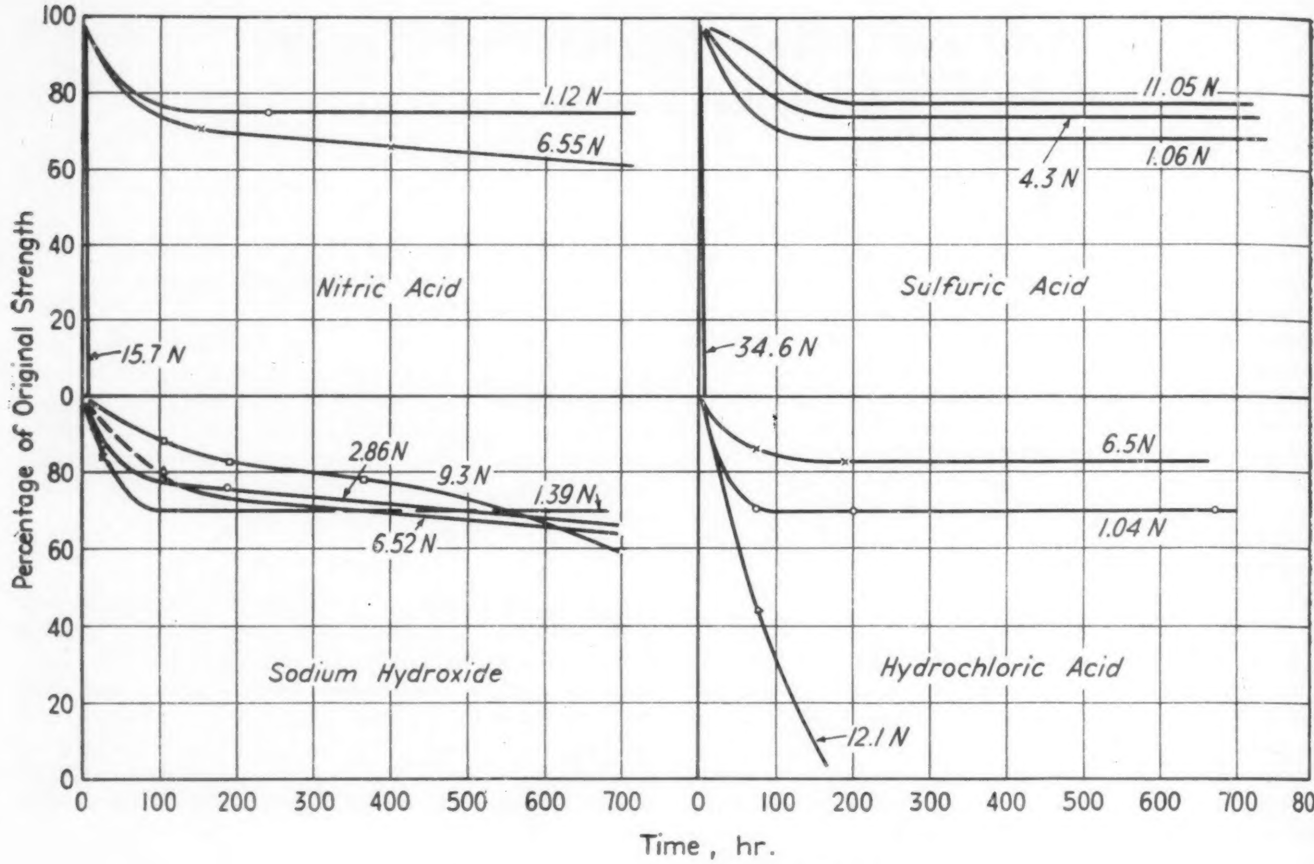

Fig. 1.—Results of Test on Cellulose Nitrate.

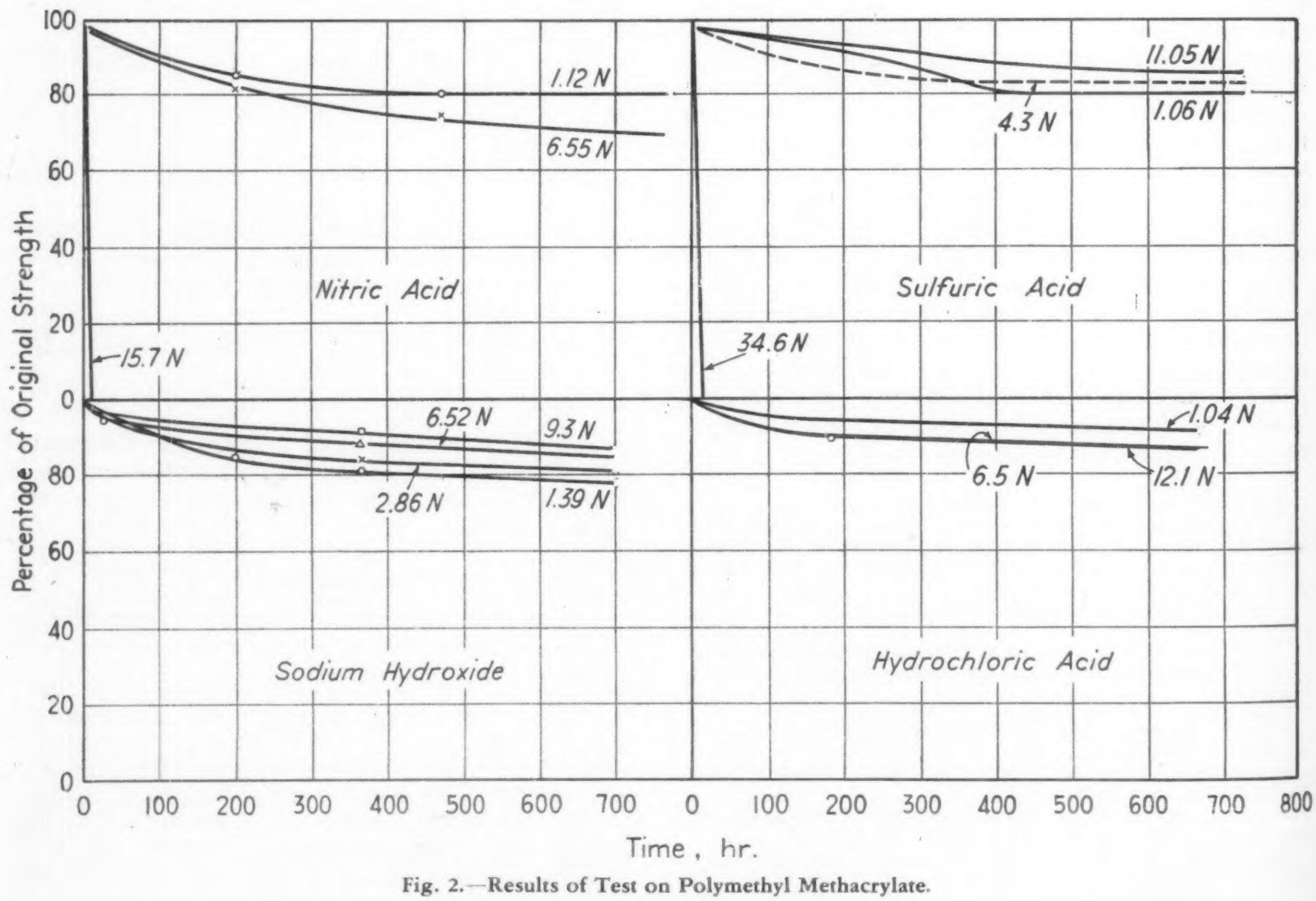

Fig. 2.—Results of Test on Polymethyl Methacrylate.

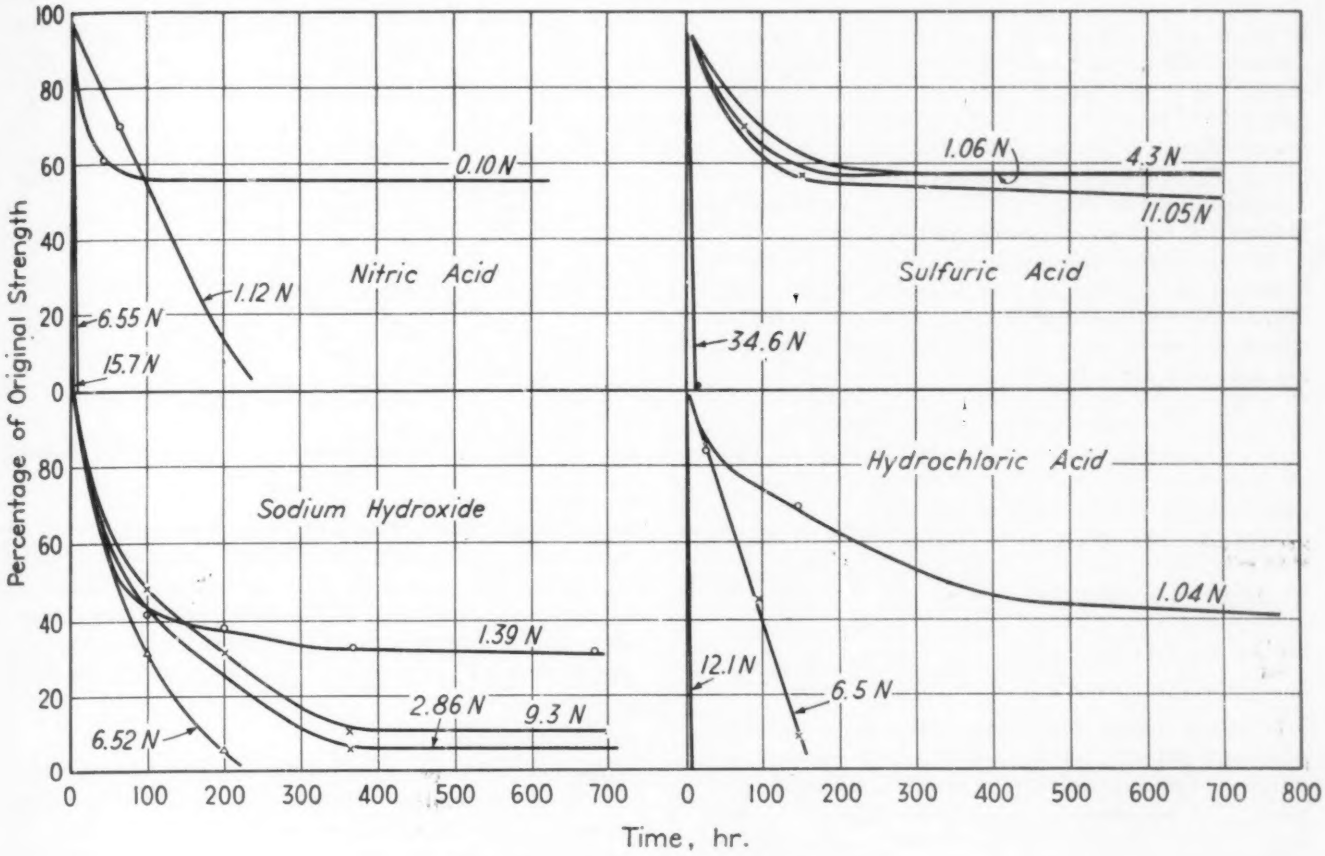

Fig. 3.—Results of Test on Cellulose Acetate.

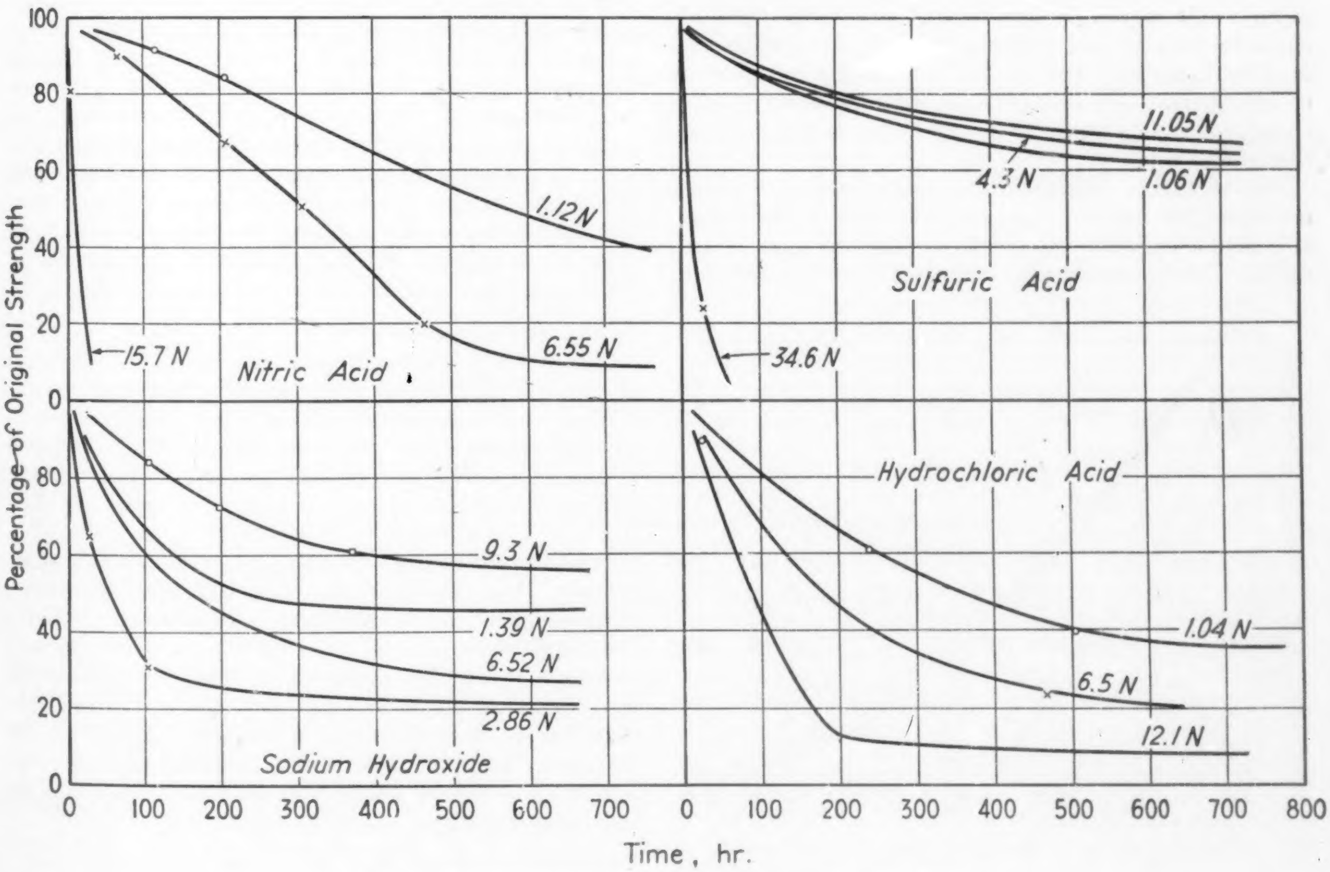

Fig. 4.—Results of Test on Laminated Phenolic Paper Base.

to an absolute unit such as shear strength. The tests determined the change from the original strength of the plastic, since this factor serves as a clue to the effect of penetration by the acid or the alkali. By reducing all quantities to the percentage variation one material may readily be compared with another.

Not reported in graphical form, yet nevertheless tested in identical manner to those materials shown in Figs. 1 to 4, are polystyrene and polyvinyl chloride-acetate. These materials were practically unaffected by all the acid and alkali concentrations employed over the entire test period, which was close to 800 hr. The data for these materials are shown in Table I.

TABLE I.—EFFECT AFTER 700 HR.

	Polystyrene	Polyvinyl Chloride-Acetate
1.39N sodium hydroxide..........	88 per cent of original strength	90 per cent of original strength
2.86, 6.52, and 9.3N sodium hydroxide	Unaffected	Unaffected
34.6N sulfuric acid...............	80 per cent of original strength	54 per cent of original strength
1.06, 4.3, and 11.05N sulfuric acid.	Unaffected	Unaffected
15.7N nitric acid.................	84 per cent of original strength	Unaffected
1.12 and 6.55N nitric acid	Unaffected	Unaffected
1.04, 6.5, and 12.1N hydrochloric acid...........................	Unaffected	Unaffected

From the foregoing it is apparent that polystyrene and polyvinyl chloride-acetate are definitely superior to the cellulose acetate, cellulose nitrate, laminated phenolic paper, and polymethyl methacrylate reported in Figs. 1 to 4. As to choosing between polystyrene and the polyvinyl copolymer, it is rather difficult to arrive at a decision. Polystyrene is more resistant to strong concentrations of sulfuric acid while polyvinyl chloride acetate is less affected by strong concentrations of nitric acid. However, in either case these materials are very much more resistant to strong concentrations of acids than the other plastics tested, which in a matter of several hours were entirely decomposed.

The method of decomposition varied somewhat. Some materials, like cellulose acetate, whitened on the surface and then eventually reduced to a shapeless mass of material. Others such as the laminated phenolic tended to delaminate in nitric acid and swell in the presence of sodium hydroxide. On the other hand, there was a visible decrease of dimensions in hydrochloric acid. When the change in the thickness of the test specimen was appreciable, a correction was made in calculating the change in punch strength as estimated in the formula indicated earlier in this paper.

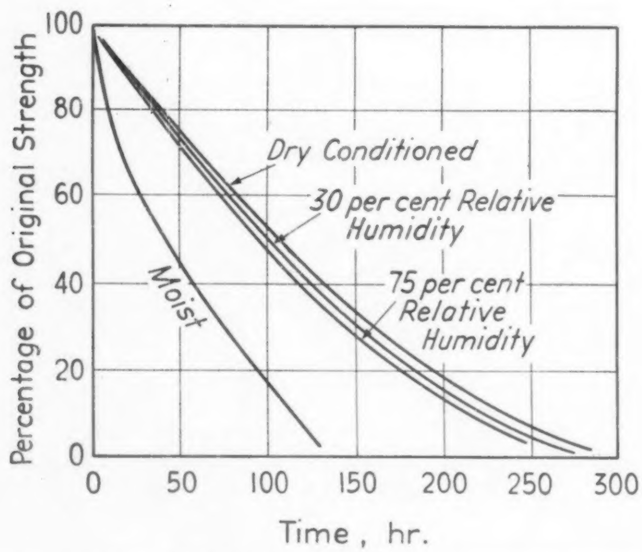

Fig. 5.—Effect of 4.4N Sodium Hydroxide on Cellulose Acetate.

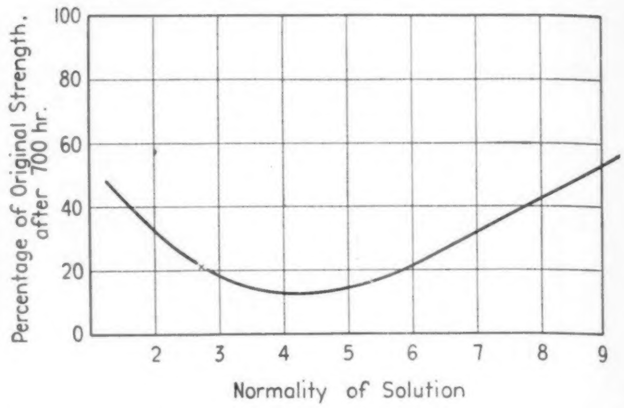

Fig. 6.—Effect of Sodium Hydroxide on Laminated Phenolic Paper Base.

Effect of Conditioning:

The effect that previous conditioning of test specimens had upon the results is shown in Fig. 5, which demonstrates the loss in strength in cellulose acetate, not only as a function of time but also of moisture content. Employing specimens that previously had been placed in dry, 30 per cent and 75 per cent relative humidity, and water immersion for several days prior to tests, specimens of cellulose acetate were placed in a typical strong sodium hydroxide solution. It will be observed in Fig. 5 that the final strength of cellulose acetate indicated complete attack in all circumstances, though the effect of conditioning is shown in the length of time in which this is attained. Other plastic materials less susceptible to moisture than cellulose acetate were less dependent upon previous conditioning. In general, the drier a sample of plastic material, the less readily it will be attacked by acids and alkalies.

Effect of Solution Concentration:

One of the most interesting results observed in this series of tests was the fact that there is a certain range of concentrations of sodium hydroxide that is particularly active in its effect upon plastics. This range is around a 5N solution as indicated in Fig. 6. Stronger concentrations of sodium hydroxide above this range have less effect upon the plastics.

With respect to the acids, the strongest concentrations brought about the most destructive results. However, there is some evidence in the case of sulfuric acid that a condition exists similar to that observed for sodium hydroxide. It will be noted that for most of the materials tested, the 1.06N solution of sulfuric acid was more active than the 4.3N or the 11.05N solution. However, the maximum available commercial concentration of 34.6 normality was very much more active than any of the lesser concentrations.

Accuracy:

Based upon calibration tests on the load-measuring de-

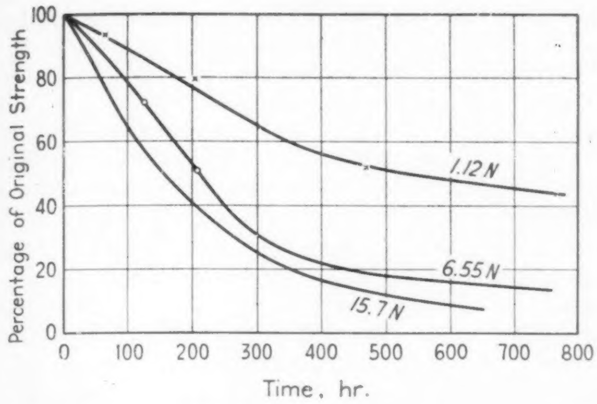

Fig. 7.—Effect of Nitric Acid on Laminated Phenolic Woven Glass Base.

vice, commercial variations in the thickness of test samples, and the ability to reproduce results, the accuracy of the readings may be taken as ±5 per cent. The large number of readings taken in each test, however, permitted a representative curve to be plotted.

Conclusions

In the case of phenolic plastics particularly, the effect of the acid or alkali is determined not only by the synthetic resin but also by the base material serving as the reinforcement. Thus, for example, it is evident in Fig. 7 that the phenolic plastic is attacked, since the glass base is impervious. Compare these data with the results for the laminated phenolic plastic material with paper base. The laminated plastics with a glass base possess considerably better chemical resistance.

By means of these tests it is possible to arrive at some quantitative comparison between the various acids and their effect upon plastic materials. For example, looking at the curves for cellulose acetate, it may be definitely concluded that nitric acid is more active than hydrochloric acid, which in turn is more active than sulfuric acid. Likewise the relative effect upon various plastics may be noted.

It may be concluded also that a quantitative determination of the effect of corrosive agents upon plastics may effectively be carried out through an examination of changes taking place in some physical property of the material upon prolonged periods of immersion.

DISCUSSION

A Member.—What was the highest sodium hydroxide concentration used?

Mr. G. M. Kline.[1]—Do you have data on the effect of the water alone?

Mr. John Delmonte.—The highest sodium hydroxide employed in these tests was about fifteen normality solution. However sodium hydroxide was most active about a $5N$ solution strength.

As to the effect of water of which Mr. Kline enquired, I must refer to a recent paper.[2] Water-absorbent materials such as cellulose acetate show a decrease in punch strength with higher humidities.

[1] Chief, Organic Plastics Section, National Bureau of Standards, Washington, D. C.

[2] John Delmonte, "Effect of Solvents on Organic Plastics," *Industrial and Engineering Chemistry*, Vol. 34, June, 1942, p. 764.

Discussion on the Measurement of Length[1]

Mr. T. A. Wright.[2]—It is noted that discussion is desired on the piscatorial measurement of length. Certain random thoughts present themselves. Some perhaps higher criticism. Some constructive, one hopes. It is assumed that others than physhermen have hopes also.

1. If this is an Ofishal method, why doesn't it so state?
2. What is the sensitivity of this Physh-scale. I know something of the sensitivity of one under a fingernail, but that's irrelevant, immaterial, and generally out of order and out of place.
3. Just what is the Affinity between a Physhtorie and an Inch Scale and a Physhscale? You will grant that fins come in somewhere.
4. Finally, if a physherman had a proper Internal Standard he wouldn't need this proposed academic method of measurement in order to keep his reputation.

I therefore move the matter be referred to E-2 Subcommittee on Internal Standards. Certainly I can't see for the life of me what Doctor Lundell has to do with it. Anyone who knows him knows that he has a line and it isn't a fish-line. When he goes near water, he goes *in it*. In fact at an A.S.T.M. committee meeting at Atlantic City he acts like a fish out of water when the tide, the temperature, and the sun are right.

Mr. H. V. Churchill.[3]—In comment on the paper on Icthyological Metrics published in the August Bulletin, the writer regrets that the author did not mention that the physhtayle is used as the ultimate unit on fish in Western Pennsylvania. The author of the cited paper probably lives in some seaboard Babylon where shtorie is piled upon shtorie to make an empire. In fairness to one of the leading lights in the School of Graduate Studies at Princeton, it should be pointed out that the physhstorie is a necessary implication of Modern Relativistics. Length is a characteristic which varies with measurement in relation to the line or direction of motion, *viz*, parallel, transverse, or in Schiaparellian patois on the Bias. Most reported piscatorial size and length data are reported parallel to veracity in that invariably there was a tangible pisces, transverse to veracity in that fish notoriously have a large shrinkage coefficient with respect to time, and on the bias in that the average fisherman invariably dramatizes his

[1] Paper on "The Measurement of Length," appeared in the ASTM Bulletin, No. 117, August, 1942, p. 24.

[2] Technical Director and Secretary, Lucius Pitkin, Inc., New York, N. Y.

[3] Aluminum Company of America, New Kensington, Pa.

accomplishments in terms of what he would have done if the blue-gill had been a big bass or a mighty muskie. In addition to the working of the Laws of Relativity, there is also the fact that piscatorial weighing and measurement also are always positively influenced by parallax errors, arising from vanity and pride. It is to be hoped that the author of the paper in his rebuttal and discussion will objectively and subjectively discuss the fact that the net result of most fishing trips is a wet you know what and a hungry viscera.

Author's Closure (Mr. E. F. Mueller[4]).—The very large volume of discussion on this subject indicated by the thickness of the September issue* of the Bulletin, in which (nearly) all of it appeared, shows that interest in the subject is widespread. The discussion is so voluminous that it will be well to consider first some general theorems regarding papers subject to discussion or editing.

Theorem I: If a technical paper is subject to review or revision by an editorial or other board, the author can assure himself of a maximum of grief by selecting a subject with which all of the members of the board are thoroughly familiar, and on which they may even rate themselves as experts.

Corollary 1.—Under such circumstances the author's only hope is that the editorial board will fight among themselves and leave his paper in peace rather than in pieces, and if he is skillful and fortunate, may succeed in acting as a catalyst to promote the reaction.

Corollary 2.—If the author fails as a catalyst, the debate may be confined to the question of chemical treatment, namely, whether the paper should be strongly reduced, or preferably, completely oxidized.

Theorem II:

If the author wishes to get through the editorial board without a trace of difficulty, he should choose a subject with which the members of the board are thoroughly familiar *ex-officio*, but which they either have never really mastered, or on which they have become rusty.

Corollary 1.—In many cases a few references to relativity and quantum theory, with some triple integrals judiciously scattered through the text will usually turn the trick, unless these were too obviously thrown in to serve as window dressing.

Corollary 2.—In case of need, sextuple integrals are many times as effective as the triple variety.

[4] Physicist, National Bureau of Standards, Washington, D. C.

* A reward of 10,000 German Marks will be paid for a September ASTM Bulletin (there is no September issue).

In this case, the author is obviously subject to Theorem I, and must defend accordingly. In extenuation, be it said that he does not fish, has no deep-sea experience and no deep-seated feelings in the matter. On the other hand, a long course of listening has given him a wide acquaintance with piscemetrology, which led to the formulation in the paper. The author cannot claim to have invented the physhtorie system, which goes back at least to Izaak Walton, and probably to the time of Joses, surnamed Barnabas. The art may well be even older.

As was noted in the discussion, page 711 $\sqrt{-1}$ the returning fisherman is a fundamentally wet and intrinsically hungry individual. That being the case, if it so happens that he has caught a fish that is *eight* times as *large* as any of those taken by his companions, he will very naturally resent being compelled, by the peculiarities of our systems of metrology and ethics, to confine himself to saying that his fish was only *twice* as *long* as any of the others. Such expedients as a favorable parallax were wholly inadequate, and compelled the evolution of the present physhtale system.

The suggestions for improvement were so numerous and to the point that the paper would have been greatly improved if they could have been received beforehand, or better still, it might never have appeared at all. Only a few of these suggestions can be considered here.

The use of the term "physhtale" in place of, or in addition to "physhtorie" would have been a great improvement although it might have raised the question as to how many shtories are required to make a physhtale. In the figure, the magnification should have been written in the customary way, × 100/254, thus avoiding the suggestion that fish should be measured to an accuracy of 1 in 4000 (ordinary scale). The omission of a reference to Committee B-4, which always gets there first, was hardly to be condoned, although except for its previous decease, A-4 might have won.

The reference to K-9, which was rather dragged in by the tail, is regretted, though it is useful in showing the ill effects of excessive attention to detail.

The list of absurd systems of length measurement at present in use should have been much more extensive, as the discussion has called attention to many omissions. The list of special verbs used in connection with various kinds of length measurements should also have been greatly extended.

Handbook for Concrete and Cement

This recent 384-page handbook gives the field and laboratory test methods and inspection procedures used by the Central Concrete Laboratory, North Atlantic Div., Corps of Engineers, U. S. Army. The publication prepared under the direction of Charles E. Wuerpel, Senior Engineer, includes a number of applicable Federal and A.S.T.M. standards and gives a number of special procedures and modifications of standards used in routine research testing of cement, aggregates, and concrete. Following the introductory chapter which includes instructions for collection and shipment of sample specimens, field inspection and field equipment, and definitions of terms, there is a 60-page section covering aggregates followed by one devoted to concrete. In Part II, devoted to cement, there are detailed various specifications and two extensive chapters dealing with chemical and physical tests of portland cement, including physical testing of clinker. There is a short discussion on water.

A significant paragraph in the Preface states: "It is the hope of those who contributed to its compilation that the Handbook will provide some additional impetus to the progress being made toward standardization of practice and a more general understanding of the control necessary in manufacture of *durable* concrete."

Copies of the book in flexible black fabrikoid, 6- by 9-in. page size can be obtained from the Central Concrete Laboratory, North Atlantic Div., U. S. Army Engineers, 320 Washington St., Mount Vernon, N. Y. Check or money order in the amount of $3 which is the cost of the volume should be made payable to the U. S. Treasurer.

Analysis of Used Lubricating Oil

Discussion of Paper by L. L. Davis

EDITOR'S NOTE.—The paper by L. L. Davis on "The Examination of Used Engine Crankcase Oil," appearing in the December, 1941, issue of the ASTM BULLETIN, was reprinted in the April, 1942, issue of the British journal *Petroleum*. Discussion of the paper appeared in subsequent issues of *Petroleum*, and is reprinted here as of possible interest to many members of the Society.

Submitted by E. R. L. Fitzpayne[1]:

Mention is made of the precautions necessary in drawing samples to ensure that these are really representative, and also of the part played by filters in continuously removing solids which, if left in suspension, would hasten oxidation of the oil; but it is unfortunate that the author deals only with gasoline engines, since the majority of the firms really interested in sump changes and oil reclamation are operating Diesel engines. Contamination of crankcase oil by soot from combustion zone is much greater with Diesel engines than with gasoline engines, and, since Diesel fuel is neither so highly refined nor so volatile as gasoline, sump dilution in a Diesel engine may have deleterious effects other than lowering of the viscosity and flash point of crankcase oil.

Most operators are in complete agreement with the author when he states that engine manufacturers' and oil companies' recommendations regarding oil drainage periods usually err on the safe side. It is generally accepted also that optimum drainage periods can be determined only by results obtained from given oil in specific equipment under given operating conditions, but the number of possible variables is large, and most firms operating Diesel engines change the crankcase oil at about half of what would be the normal period for gasoline engines.

If the conservation of oil supplies is really of paramount importance at the present time attempts should be made to lengthen the useful life of crankcase oil by the addition of inhibitors and by very careful attention to the state of filters, thereby increasing drainage period. Some of the oil refiners might be prevailed upon to institute a reclamation service, capable of furnishing a finished product more or less akin to the original oil, although the collection in small amounts of used crankcase oil, and subsequent treatment, would doubtless not be a sound economic proposition.

Assessing the optimum drainage period of crankcase oil is a difficult matter, and usually results in a compromise between engine condition and economy. Most fleet operators draw up a maintenance scheme on a mileage basis and arrange for a given number of sump changes between engine overhaul periods. When lubricants were cheap and plentiful, flushing out sumps with a slightly thinner oil was perhaps sound enough practice, but not under present conditions. Since Diesel-engine crankcase oil is contaminated to a much greater extent by soot and other combustion zone products than is gasoline-engine crankcase oil, the drainage period of the former may be fixed at about half that of the latter (say 5000 to 7500 miles for Diesel and 10,000 miles for gasoline engine).

The determination of the various amounts of internal and external contaminants in used crankcase oil may well serve as an indication of the fitness or otherwise of the oil for a longer period of service, but the type and state of filters can vitiate the figures to such an extent that the information obtained, however well interpreted, is not over-reliable unless samples are drawn at short intervals, which is quite impracticable with large fleets.

An examination of solvent-processed oil from four Diesel engines revealed the fact that the free carbon in suspension was in each case very much higher at 4000 miles than at 8000 miles, and was undoubtedly due to asphaltic and sludge bodies building up on the face of filter and becoming a more efficient filtering medium than the filter itself, but this would result in a slowing down of the rate of filtration, and the bulk of the oil would simply by-pass.

Improved filtering systems and rigorous attention to their maintenance, together with a more extended use of inhibitors (antioxidants), appear to be the most practicable way of increasing the useful life of crankcase oil.

Submitted by J. Brierley[2]:

There is no doubt of the great change which occurs in lubricating oil after it has been in use for a considerable time, such as fuel dilution, water content, carbon residue, metal content, etc.; but, as we know, it is an analytical chemist's job to determine the proportion of each contaminant in the oil, and the effect of such contaminants on the life of an engine.

It is recognized that an engine which is in good condition will keep its oil clean longer, and consequently less wear and tear occur; but an engine which is worn, say, 75 per cent of its normal working life, is much dirtier, owing to slackness of pistons allowing the gases from the combustion chamber to pass by into the crankcase and dilute the lubricating oil, which in turn causes a more rapid wear of cylinders and bearings, owing to the oil losing its lubricating properties and becoming contaminated with carbon and metal deposits.

If engine oil was more frequently renewed it is obvious that the engine would be working under better conditions; but where there is a large fleet of buses a great amount of used oil would have to be stored and cleaned again for further use, and if we get too much reclaimed oil for topping up it would tend to reduce the quality of the new oil after being mixed together.

This, in my opinion, is the main point, and it would be interesting to know the opinion of the chemists on the following questions after testing oil taken from a crankcase and reclaimed by a purifier:

Has it lost any lubricating qualities owing to its being previously in use?

Is there room for further improvements in the manufacture of oil purifiers?

[1] Deputy General Manager, Transport Dept., Corporation of Glasgow, Scotland.

[2] General Manager, Transport Dept., County Borough of Wigan, England.

Submitted by G. H. Pulfrey[3]:

The sumps of our gasoline engines are drained after 8000 miles and of oil engines after 4000 miles. These figures are averages, taking account of the engines approaching overhaul and those recently placed in commission. While some of our vehicles do operate longer daily services than others, in a district which is practically all flat mileage, this is as satisfactory an arrangement for oil changing as can be obtained.

It is appreciated that in some districts where there is a great amount of first and second gear work, if vehicles are kept solely on the routes necessitating a much greater number of revolutions in proportion to mileage, changes should be made more frequently to obtain the best results.

The conclusions of the author do not, in my opinion, leave much to be said. He points out that results are mainly academic and that experience must be the deciding factor in obtaining the most satisfactory results.

The chief engineer of one of the largest omnibus companies in the provinces, who wishes to remain anonymous, offers the following five tests of the efficiency of lubrication practice.

We are in complete agreement with the main conclusions reached by the author, particularly with regard to the determination of correct oil-changing periods and the need for strict enforcement of this work on a routine basis.

This in actual fact is our own method of work. We have decided that the maximum desirable mileage is 5000, and every effort is made to change the oil at this period.

It must be stated, however, that, while we agree with the general principles of the author's paper, we feel that a great deal of the oil-analyzing work is unnecessary from an operator's point of view. With regard to the control of oil-reclamation methods, it is considered that for all practical purposes the following facts should be determined:

(*a*) Specific gravity.
(*b*) Closed flash point.
(*c*) Viscosity (Redwood).
(*d*) Dilution. (Items (*b*) and (*c*) give a good indication of the amount of dilution, but the percentage is determined for record purposes.)
(*e*) Color (as an indication of the efficiency of filtration).

We are sure that, if the data from this simple analysis are kept within fairly close limits, no trouble is likely to result, and in fact, as we have found, some benefit will be derived.

That this procedure is reasonably satisfactory is proved by the results we obtain, for although we do not use expensive grades of oil, certainly not of the solvent extract type, and although we do not resort to the use of inhibitors, apart from any that may be added by the oil manufacturers, yet we can honestly say that we do not experience any piston or piston-ring troubles whatsoever. Gummed-up piston rings, either on our gasoline or compression ignition engines, are definitely unknown.

Referring to the question of corrosion, we have not made a practice of routine analysis for either organic or inorganic acids, although we make a snap check about once every three months, and this enables us to determine the general condition of our lubricant from this particular angle.

I would reiterate that we agree with the author's findings in general principles, and would add that it is essential that some knowledge of the analysis of used engine oils is obtained, and a practical use made of this knowledge, if the best results are to be obtained from the engine unit.

Submitted by R. Stuart Pilcher[4]:

My Rolling Stock Superintendent, Mr. Whalley, has read the paper on "The Examination of Used Engine Crankcase Oil" and reports that while many of the tests described are beyond the capacity of the majority of operating engineers, the conclusions reached by Mr. L. L. Davis largely confirm the practice which has been adopted in Manchester.

Our lubricating oils are normally bought on contract against a specification, and regular test samples are taken and checked from the various deliveries, the services of a qualified oil chemist at the electricity power station being used for this purpose.

For many years now my engineers have worked in close cooperation with the chemists of the oil suppliers in the checking of samples of used oils. From these experiments, a permissible increase of viscosity was established for each type of oil and engine.

The department has its own small laboratory, and an assistant trained in the use of the Redwood viscometer. Samples, regularly taken from engines in the garages, are checked by him and the mileage of engine oil changes adjusted accordingly. Any unusual result is rechecked, and if confirmed the sample concerned is sent to the supplier for his observations. Incidentally, this assistant also makes regular checks on the Diesel index of the gas oil used by the department.

We have three systems of recovering used crankcase oil at present:

1. Oil from certain garages is returned to the supplier, who filters and reblends it to its original viscosity before returning it.

2. Our own reclamation installation, which is used for filtering only.

In both the above cases the oil concerned has been used in compression ignition engines.

3. Gasoline-engine oil which is cleaned in a filter and used for lubricating tramcar axle boxes. We have very few gasoline engine buses left. As their crankcase oils are liable to suffer from dilution, it has been considered more satisfactory to use the cleaned oil in tramcars.

Submitted by P. W. L. Gossling[5]:

With regard to the first question raised by Mr. Brierley—as to whether reclaimed crankcase oil has lost any lubricating qualities owing to its being previously in use—any answer must depend on a definition of "lubricating qualities." If the term is to be taken in its narrowest sense to refer to the ability of the oil to reduce friction between the metal surfaces, then the bulk of opinion is that the oil has not suffered appreciably in this respect and it is, in fact, even claimed that some slight improvement has resulted. This omits any consideration of questions of load-carrying

[3] General Manager, Transport Dept., City and County of Kingston-upon-Hull, England.

[4] General Manager, Transport Dept., Manchester Corp., England.

[5] Chief Chemist, W. B. Dick and Co., Ltd.

capacity, particularly at high temperatures, which will be dependent to some extent on any reduction in viscosity due to dilution.

If, on the other hand, the term "lubricating qualities" is taken as embracing all the properties, including viscosity, coke value, stability to oxidation, etc., that govern the suitability of an oil for internal-combustion engine use and its probable useful life, then the degree of deterioration suffered by the oil in service prior to reclamation and the type and efficiency of the reclamation process must be taken into account. It will be assumed that the reclamation process has effected complete removal of water and solid matter, but if this is the total effect, the oil will certainly be inferior in oxidation stability to the new oil, higher in acidity, and higher in coke value. However, if dilution is not excessive, the oil may still be in satisfactory condition for further service, though without any expectation of a useful service life approaching that of new oil. If reclamation includes complete removal of diluent by distillation, the viscosity of the recovered oil is likely to be higher than that of the new oil, since oxidation tends to raise the viscosity, but where deterioration has not taken place to a serious extent the viscosity will not be greatly increased.

Some reclamation processes involve actual refining of the used oil by means of chemicals or earth, or both, and if such a process also includes means for removal of diluent, an oil which is only slightly oxidized may be returned to a condition approximating that of the new oil. Such a result must not be expected with most oils, but in any case, an improvement in stability as compared with the same used oil after removal of moisture and solids should result.

A word of warning might be interposed here. Some of the oils on the market in recent years are dependent, for part at least of their lubricating efficiency, on added materials or "dopes." In cases where such oils are used, it must be considered whether the method of reclamation adopted is one which effects partial or complete removal of the additive. This points to the desirability of chemical control of reclamation.

To Mr. Brierley's second question—as to whether there is room for further improvement in the manufacture of oil purifiers—any answer other than "yes" would be a negation of modern progress. The aim is, of course, for a purifier which will restore used oil, whatever its state, to practically new condition at very low cost and with very little loss of oil, but reclamation equipment can fall far short of this and still be of considerable value. The user can obtain plant which will remove water and solids with little oil loss and at low running cost, or more ambitious plant which adds to this the removal of diluent and a degree of refining of the oil at a greater cost in materials and oil loss. Whatever type he adopts he will know that it is not the final answer to his problems, and that next year or the year after there will be a better model of the same type, but the same was true of his car, and this did not, in brighter days, reduce the sales of these articles.

Specification and Description of Color[1]

DURING THE Washington Spring meeting in 1941, the American Society for Testing Materials sponsored jointly with the Inter-Society Color Council a Symposium on Color—Its Specification and Use in Evaluating the Appearance of Materials. Five speakers discussed several aspects of color specification with which A.S.T.M. members are concerned, each speaker referring in one way or another to certain colorimetric procedures that have become increasingly well known in the past few years to the small group of specialists whose work is chiefly concerned with color. The fact that certain of these procedures are becoming standard practice may not be so well known to those in general industrial groups who have use from time to time for color specification. Speed and efficiency are required more than ever in these days of industrial war problems, and standards that point immediately to methods that are already standard practice in specialized fields are a real necessity.

American War Standard Z44 of the American Standards Association, approved June 17, 1942, for the Specification and Description of Color fills just such a need. It puts on record a basic method to which other colorimetric methods can be referred, and provides other methods, already calibrated in terms of basic specification, which should serve to cover most color specification problems that arise.

For the most general case, there is the need for a descriptive color designation that indicates what the color is: a "vivid orange," a "pale yellow," or a "deep green." The limits for each designation in a system of such color names are already established in the ISCC-NBS[2] system of color designations, and Provision 4 of Z44 recommends that system whenever general comprehensibility is desired and precision is not important. For visual comparison, and a popular designation that can vary in precision according to the tolerance required, Provision 3 recommends the use of the Munsell notation. For color specifications computed from basic specifications, Provision 2 requires that standard I.C.I. specifications (Y, x, y) shall be used, or Y, dominant wavelength, and purity, which may be computed from I.C.I. specifications. For basic work, Provision 1 recognizes the spectrophotometer as the fundamental instrument in the standardization of color.

These four provisions of Standard Z44 are coordinated. This fact cannot be overemphasized; it is the reason that the standard should prove widely useful. Provision 4 provides for color names that are defined in terms of Provision 3. Provision 3 provides for a notation that can be used with or without reference to its calibration in terms of Provision 2. And Provision 2 depends for its basic quality upon its relation to Provision 1. Thus in Z44 there is a specification to suit most color specification needs, and whatever Provision is used, it is already co-

[1] Prepared at the editor's request by Dorothy Nickerson, Secretary, Inter-Society Color Council; Agricultural Marketing Administration, Washington, D. C.

[2] Inter-Society Color Council—National Bureau of Standards.

ordinated with the others. If in a printing plant or a paint factory the Munsell notation of a desired color is known, that specification can be put into I.C.I. terms for laboratory use by reference to preliminary conversion charts that already have been made available. Many color problems are answered by use of a specific instrument or by special color standards; for purposes of understandability results in terms of such instruments and standards can be converted so that they may be expressed not only in their own terms but also in terms of color specifications named in Z44, so that they may be widely understood and interpreted.

One or another of the four provisions of Z44 is used to obtain practically all colorimetric results that have to be transmitted and used at a later time or another place. In some industrial and research institutions all of the provisions are found useful, in fact the General Electric Co. and the Interchemical Corporation found this coordinated color idea so helpful that they initiated the request resulting in this War standard. For some years the National Bureau of Standards and the U. S. Department of Agriculture have regularly used among others all four provisions, and the coordination of the methods specified in Provisions 1 to 4 grew out of their need for it.

Full provisions of this standard are reproduced here with the hope that they may prove useful to many A.S.T.M. members. They should be of particular use in applications in the field of paints, varnishes, lacquers, textiles, as well as other commodities in which the Society has an interest

American War Standard Specification and Description of Color

(ASA—Z44-1942)

1. Purpose

To recognize and recommend a basic method for the specification of color, and to facilitate its popular interpretation.

2. Provisions

2.1* The spectrophotometer shall be recognized as the basic instrument in the fundamental standardization of color.[1][3]

Note: Specifications of the spatial distributions of the incident and collected light are essential to the standardization of spectrophotometry. Until standard conditions are established by agreement, the particular conditions employed in each instance should be stated clearly.

2.2* Color specifications computed from spectrophotometric data shall be found by means of the standard observer and coordinate system adopted in 1931 by the International Commission on Illumination.[2, 3, 4]

In the absence of a special reason for adopting some other illuminant in reducing spectrophotometric data, standard ICI illuminant C, representative of average daylight, shall be used.[2, 3, 4]

The basic specifications of color shall consist of the tristimulus value, Y, and the trichromatic coefficients, x and y, of the ICI coordinate system, or they shall consist of the tristimulus value, Y, and the dominant wavelength and purity.[3, 4]

Note: Dominant wavelength and purity are obtainable by computation[3,4] from the trichromatic coefficients, x and y. Several methods of expressing purity have been proposed and used to some extent. In this standardization, purity refers to the quantity which is called excitation purity in discussions[4, 5, 6] of the several possible purity scales. For the sake of uniformity, the symbol, p, and expression in terms of per cent is recommended for purity. Likewise, when Y is specified in terms of reflection factor it should be expressed in per cent, symbol, R. It is customary to express dominant wavelength in millimicrons, mμ, and this practice is recommended, together with the symbol, λ.

2.3* For the popular identification of color, material standards may be used. The only system of material standards that has been calibrated in terms of the basic specification is represented by the 1929 edition of the Munsell Book of Color.[7, 8] The use of this book is recommended wherever applicable to the specification of the color of surfaces. Approximate identifications of Munsell hue, value, and chroma may be secured by direct visual comparison with the samples in the 1929 Munsell Book of Color. When the most accurate visual comparisons are needed, the mask method[9] is recommended. Wherever more exact Munsell notations are desired, they shall be found from the basic specification, Y, x and y by interpolation among the smoothed curves[10, 11] for Munsell hue, value, and chroma.

Note: Most surfaces whose colors fall outside the range covered by the samples of the 1929 Munsell Book of Color cannot be assigned Munsell notations by reference to the smoothed curves. For such surfaces, for transparent media, and for illuminants, only the basic specification Y, x and y, or Y, dominant wavelength and purity are recommended.

2.4 A descriptive name according to the ISCC-NBS system of color designation[9, 12] may be derived from the Munsell notation. This name is recommended wherever general comprehensibility is desired and precision is not important. The use of color names for color specification is not recommended.

Note: It should be emphasized that the ISCC-NBS names are descriptive only and are not adapted to sales promotion nor intended to replace names that are developed for that purpose.

* The alternative, but coordinated systems of color specification described in 2.1, 2.2, and 2.3 are each adequate for specification of color tolerance in those cases for which each system is useful and convenient. As in all engineering specifications, the tolerances in different industries vary and depend upon the uses for which the products are intended. Color specifications according to 2.2 and 2.3 are, strictly speaking, appropriate only for products viewed by normal vision, but in the absence of agreement on standards for anomalous color vision or vision at low illuminations no more appropriate color specifications are available.

[3] The single numbers in brackets throughout the text refer to "References" appended to this standard.

References

[1] ASTM Standard, *Method of Test for Spectral Apparent Reflectivity of Paints*, D 307 – 39.

[2] *Proceedings, Eighth Session, Commission Internationale de l'Eclairage*, Cambridge, England, September, 1931, pp. 19–29.

[3] D. B. Judd, "The 1931 I.C.I. Standard Observer and Co-ordinate System for Colorimetry," *Journal of the Optical Society of America*, Vol. 23, pp. 359–374 (1933).

[4] A. C. Hardy, *Handbook of Colorimetry*, Technology Press, Cambridge, Mass. (1936).

[5] D. B. Judd, "A General Formula for the Computation of Colorimetric Purity," *National Bureau of Standards Journal of Research*, Vol. 7, pp. 827–841 (1931).

[6] D. L. MacAdam, "Photometric Relationships between Complementary Colors," *Journal of the Optical Society of America*, Vol. 28, pp. 103–111 (1938).

[7] *Munsell Book of Color* (standard edition with complete explanatory matter; abridged edition adapted for comparisons), Munsell Color Company, 10 East Franklin St., Baltimore, Md. (1929).

[8] J. J. Glenn and J. T. Killian, "Trichromatic Analysis of the Munsell Book of Color," *Journal of the Optical Society of America*, Vol. 30, pp. 609–616 (1940).

[9] D. B. Judd and K. L. Kelly, "Method of Designating Color," *National Bureau of Standards Journal of Research*, Vol. 23, pp. 355–385 (1939); RP 1239.

[10] D. Nickerson, "Use of the I.C.I. Tristimulus Values in Disk Colorimetry," U. S. Department of Agriculture (May, 1938); mimeograph copies obtainable on request.

[11] S. M. Newhall, "Preliminary Report of the O.S.A. Subcommittee on the Spacing of the Munsell Colors," *Journal of the Optical Society of America*, Vol. 30, pp. 617–645 (1940).

[12] D. Nickerson and S. M. Newhall, "Central Notations for ISCC-NBS Color Names," *Journal of the Optical Society of America*, Vol. 31, pp. 587–591 (1941).

Application of Rank Correlation to the Development of Testing Methods[1]

By E. R. Schwarz[2] and K. R. Fox[2]

Some of the problems that frequently arise in statistical handling of data may be expressed in the following manner. How should nondimensional, qualitative results be treated? Are there any rigid mathematical methods that can be employed? Are there any conventional significant tests available to test the validity of the data? Does the test in question best represent service conditions? It is the purpose of this discussion to attempt an answer to these questions and perhaps suggest a more efficient approach to their solution.

The utility of textile testing methods is becoming more apparent. With the systematic planning of experimental tests, augmented by intelligent handling of data (*1*),[3] it is possible to evaluate the true significance of the results. Both of these phases of testing are of paramount importance and should not be divorced from each other. However, in the following discussion, the latter problem, that is, the handling and the presentation of the data, will be emphasized. Nevertheless it should be remembered that these statistical methods must be preceded by rigid experimental design to contribute the greatest value to the testing procedure.

Qualitative data may usually be arranged in order of excellence to form what we shall call a "rank." In other words, an assignable value, such as the ordinal numbers one, two, three . . ., etc., can be attributed to each sample. For example, ten samples may be exposed in the conventional Fade-Ometer in order to investigate their fastness to light. As a result of the test, each sample should have a definite rating with respect to the others. In the absence of specific analyzing apparatus such as the spectrophotometer, the problem of evaluating these samples becomes one of sensitiveness of the human eye. However, it is possible for a number of individuals to rank these ten samples in what they consider to be their relative excellence. Their ability to rank these samples in a similar fashion leads immediately to a discussion of rank correlation which offers a solution to this apparently perplexing problem.

Kendall Rank Correlation

The Kendall rank correlation coefficient technique is outlined in brief in Table I. Here example 1 shows rank *A* and rank *B* which are in perfect agreement, whereas example 2 indicates two hypothetical ranks which are in inverse relationship. The technique of calculation consists of placing the first rank in numerical sequence and in general in increasing order as has been done in each example. Looking then at rank *B* in each case, the number of figures to the right of each digit which are greater than that digit in magnitude is tabulated as shown. Thus, for example 1, the first digit of rank *B* (which is 1) has nine figures to the right greater than itself as indicated in the third column of the table. Similarly, digit 6 has four figures to the right which are greater than itself in magnitude. In similar fashion the data of example 2 may be studied and here for instance digit 6 of the second column of Table I has no values to the right of it greater than itself. The last two columns of Table I are then summed and this summation is noted as K. The value of K is then substituted in the expression derived by Kendall (*2, 3*) giving a value of Σ which in turn is substituted in the final formula for the correlation coefficient τ.

Fundamentally the scheme used is based upon a scoring system which counts a positive score for each pair of figures which appears in the correct sequence and a negative score for each pair of figures which is in inverse sequence. The combination is given as Σ. The final correlation is in the form of the value τ and is presented as a fraction in which τ is compared with the maximum possible score for a perfect case as shown in example 1. This takes the form mathematically of the fraction $\frac{n(n-1)}{2}$, which is derived from an arithmetic progression. It will be apparent from these examples that τ may take values ranging from -1 which indicates opposite ranking to $+1$ which indicates perfect correlation. A value of zero or nearly zero would indicate more or less random relationship between the ranks.

As an example of the use in a specific case (*4*), rank *A* and rank *B* of example 1 of Table II represent the stiffness ratings of ten different fabrics tested on two different ma-

TABLE I.—KENDALL RANK CORRELATION COEFFICIENT.

Example 1

Rank *A*	1	2	3	4	5	6	7	8	9	10
Rank *B*	1	2	3	4	5	6	7	8	9	10

Example 2

Rank *A*	1	2	3	4	5	6	7	8	[illegible]	10
Rank *B*	10	9	8	7	6	5	4	3	[illegible]	1

To the Right of		Number of Greater Figures	
Ex. 1	Ex. 2	Ex. 1	Ex. 2
1	10	9	0
2	9	8	0
3	8	7	0
4	7	6	0
5	6	5	0
6	5	4	0
7	4	3	0
8	3	2	0
9	2	1	0
10	1	0	0
$n = 10$		Sum $= K = 45$	0

$$\Sigma = 2K - \left[\frac{n(n-1)}{2}\right] \qquad \tau = \frac{2\Sigma}{n(n-1)}$$

Case I $\tau = +1$
Case II $\tau = -1$

NOTE.—DISCUSSION OF THIS PAPER IS INVITED, either for publication or for the attention of the author. Address all communications to A.S.T.M. Headquarters, 260 S. Broad St., Philadelphia, Pa.

[1] Paper presented at the fall meeting of Committee D-13 on Textile Materials of the American Society for Testing Materials, October 16, 1941, New York, N. Y.

[2] Professor of Textile Technology, and Instructor in Textile Technology, respectively, Massachusetts Institute of Technology, Cambridge, Mass.

[3] The italic numbers in parentheses refer to the reports and papers appearing in the list of references appended to this paper.

TABLE II.—SIGNIFICANCE TEST FOR STIFFNESS RANKINGS.

Example 1

Rank *A*	1	2	3	4	5	6	7	8	9	10
Rank *B*	1	2	5	3	8	4	9	6	7	10

$K = 38 \qquad \Sigma = 31 \qquad \tau = 0.69$

Example 2

Rank *A*	1	2	3	4	5	6	7	8	9	10
Rank *B*	3	4	7	5	2	10	1	6	8	9

$K = 30 \qquad \Sigma = 15 \qquad \tau = 0.33$

Significance Test

$$t = \sqrt{\frac{\tau^2(n-2)}{1-\tau^2}} \qquad \text{D. of F.} = n - 2, \quad n = 10$$

Example 1

$$t = \sqrt{\frac{(0.69)^2(10-2)}{1-(0.69)^2}}$$

$t = 2.70$
$t_c = 2.31$ (5% level)

Example 2

$$t = \sqrt{\frac{(0.33)^2(10-2)}{1-(0.33)^2}}$$

$t = 1.00$
$t_c = 2.31$ (5% level)

Example 1—Rankings are significantly alike.
Example 2—Rankings are not significantly alike.

chines and in this instance the ratings of rank *A* have been arbitrarily selected to be placed in numerical sequence. It would make no difference in the results if rank *B* had been so chosen. With rank *A* in numerical order, rank *B* is then arranged with each value to correspond and gives the sequence of digits noted in the table. Carrying through the process already outlined in Table I the value of *K* is seen to be 38 and that of Σ to be 31, while τ becomes 0.69 (positive). This would indicate superficially that there was a definite tendency for the two rankings to place the stiffness values as determined by the two different instruments in similar order but that this order was definitely not perfect. However, it is unsafe to make this statement without investigating the actual significance of the value of τ. What is being tested is actually whether τ is significantly different from zero when a value of zero would indicate no relationship either direct or inverse between the two ranks. It should be clearly understood that if τ is negative its significance may still be shown to be great. In this case, however, the instruments would be found to rank the samples in opposite directions.

One of the definite recommendations for use of the Kendall correlation coefficient for rank (*4*) is that it is so distributed that it becomes possible to test the significance of the coefficient by means of the well-recognized *t* test (*5*). Reference to Table II will indicate the application of this method. (It will be noted that the formula for *t* as given in Table II is similar in form to that usual for a *t* test of the significance of a correlation coefficient in general.) Using this formula in conjunction with $(n - 2)$ degrees of freedom and substituting the values shown in Table II for τ and *n*, the value of *t* equals 2.70 is established. For $n - 2$ degrees of freedom the critical value, t_c, is found from a table of values of *t* to be 2.31 at the 5 per cent probability level of significance. Since the value of *t* obtained from the data is substantially greater than the critical value t_c, it can be stated that the correlation coefficient of 0.69 is significantly different from zero and hence that the rankings are statistically alike. If this same procedure is followed for example 2 of Table II, it will be found that these rankings are not significantly alike. The actual value of *t* for this example is also shown.

Kendall Coefficient of Concordance

It will be apparent from the foregoing that the Kendall coefficient of rank correlation applies to a comparison of two ranks. There will be, however, many instances in which more than two ranks are available for study and when it will be desirable to make an over-all comparison before investigating pairs of ranks separately. Frequently a study of this character will save a considerable amount of time in avoidance of unnecessary comparison of pairs of ranks. The technique used in this instance has also been developed by Kendall (*6, 7*) and is known as *concordance coefficient* represented by the symbol *W*. Table III gives two examples of the use of the coefficient of concordance where three ranks of five values each are to be studied concurrently.

Example 1 of Table III indicates perfect correlation between all three ranks, whereas example 2 of the same table indicates a random relationship between the three ranks. The data are given for purposes of illustration only since it would be apparent at a glance that example 1 shows perfect correlation without the necessity of any computation. That the method is of value, however, is shown by example 2 where the relationship, if any, is not nearly so apparent. A study of the two examples will indicate that where perfect correlation is present there is a grouping of small values and similar values in vertical columns at the left of the ascending sequence and a grouping of similar but larger values as the sequence progresses in ascending order. Thus if the values in each vertical column are added, different totals will be obtained and perfect correlation will be an arithmetic progression with an interval equal to the number of ranks. In contrast to this, example 2 will indicate that where the arrangement of digits in each vertical column is random, each column will then total the same or substantially so in more complex instances. Stated simply, therefore, it may be said that if the total of the columns of the ranks are substantially alike it is to be suspected that the value of the coefficient of concordance will approach zero. If the totals are very different as progress is made along the rank, it will be anticipated that the value of the coefficient of concordance will approach 1. The actual computation, as will be seen by reference to Table III, involves a computation of the sums and the squares of the sums giving values of *u* and u^2 which can be substituted in a formula for an expression denoted as *s*. This value *s* essentially shows the deviation of the u^2 values from the mean u^2.

As for the correlation coefficient, this statistic *s* is then introduced into a formula for the concordance coefficient which again is a fraction in which the value *s* is compared with the maximum possible score obtainable under perfect correlation conditions. This is expressed by the frac-

TABLE III.—KENDALL CONCORDANCE COEFFICIENT.

$n = 5 \qquad m = 3$

	Example 1					Example 2				
Rank *A*	1	2	3	4	5	1	2	3	4	5
Rank *B*	1	2	3	4	5	3	4	5	1	2
Rank *C*	1	2	3	4	5	5	3	1	4	2
Sums = u =	3	6	9	12	15	9	9	9	9	9
u^2 =	9	36	81	144	225	81	81	81	81	81

Example 1: $\Sigma u = 45 \qquad \Sigma u^2 = 495$

Example 2: $\Sigma u = 45 \qquad \Sigma u^2 = 405$

$$s = \Sigma u^2 - \frac{(\Sigma u)^2}{n} \qquad W = \frac{12s}{m^2(n^3 - n)}$$

Example 1

$s = 90$
$W = +1$

Example 2

$s = 0$
$W = 0$

TABLE IV.—COTTON FINENESS DATA—GRIMES.

Cotton	Sample	Weight, Micrograms per In.	Ribbon Width, microns			
			Collapsed	In NaOH	Mercerized	Mercerizd Width Minus Lumen
A	No. 1..	4.15	18.10	23.22	13.29	12.72
	No. 2..	3.90	18.54	25.02	14.58	13.30
	No. 3..	4.72	17.74	22.60	13.99	12.92
	No. 4..	4.94	18.04	22.51	13.94	13.12
	No. 5..	4.23	17.89	23.18	13.39	12.55
	Avg.....	4.39 (2)	18.06 (1)	23.31 (1)	13.84 (1)	12.92 (1)
B	No. 1..	6.50	21.21	27.59	16.98	16.09
	No. 2..	5.24	21.60	28.74	15.40	14.09
	No. 3..	5.40	21.01	26.13	15.58	14.94
	No. 4..	6.05	22.47	28.55	15.76	14.78
	No. 5..	5.14	20.11	26.46	15.89	15.30
	Avg.....	5.67 (5)	21.28 (5)	27.49 (5)	15.92 (3)	15.04 (3)
C	No. 1..	4.44	17.68	22.64	14.52	14.08
	No. 2..	4.70	17.94	25.61	15.70	15.00
	No. 3..	6.03	18.92	25.63	16.41	16.24
	No. 4..	5.78	19.61	25.59	17.22	17.10
	No. 5..	5.76	19.00	26.62	15.96	15.42
	Avg.....	5.34 (4)	18.63 (3)	25.22 (3)	15.96 (4)	15.57 (4)
D	No. 1..	4.68	17.85	23.95	15.66	14.58
	No. 2..	3.68	19.16	24.81	16.04	14.75
	No. 3..	3.54	18.68	25.53	15.37	14.36
	No. 4..	4.58	18.52	24.93	16.02	14.20
	No. 5..	4.57	17.67	23.24	15.15	14.70
	Avg.....	4.21 (1)	18.38 (2)	24.49 (2)	15.65 (2)	14.52 (2)
E	No. 1..	4.76	18.37	24.79	15.00	15.53
	No. 2..	4.56	18.01	24.24	16.01	16.14
	No. 3..	4.57	19.50	26.64	16.47	15.21
	No. 4..	5.86	18.91	27.42	16.25	15.65
	No. 5..	4.90	19.04	24.54	15.23	14.73
	No. 6..	4.97	22.22	29.31	18.90	14.98
	No. 7..	5.30	19.70	25.71	16.69	15.14
	No. 8..	5.71	20.24	26.84	16.72	16.53
	No. 9..	5.03	20.32	26.32	18.21	16.41
	No. 10..	5.06	18.74	25.74	15.87	15.57
	Avg.....	5.07 (3)	19.50 (4)	26.26 (4)	16.54 (5)	15.59 (5)

NOTE.—The numbers in parentheses following the averages indicate the order in which the cottons rank in fineness by each method.

tion $\frac{m^2(n^3 - n)}{12}$. Examination of the results of substitution in these formulas for the two examples noted in Table III gives values of W equalling 1 and zero, respectively, and indicate that for example 1 the correlation is perfect and for example 2 is random.

In addition to its usefulness as a means of expressing quantitatively data which might otherwise be difficult of analysis from even a qualitative standpoint, consider the data of Table IV which presents findings obtained by Grimes (*8*). Reference to this table will indicate that not only are the individual values of data reported but also in parentheses are noted the relative ranks of the observations. Here is the necessary information for a study by means of the Kendall technique to indicate whether or not the various methods used for determining the fineness of cotton are all similar or whether there may be significant differences in the results obtained by different techniques. This method of presentation of data is to be recommended wherever it is suspected that a rank correlation study could be made.

Handling Experimental Data

If such an analysis is made of the data of Table IV, the results shown in Table V are obtained. The values quoted represent the rankings as shown by the actual data and are the figures appearing in parentheses in Table IV. There are evidently five ranks of five values each in this setup of the data and when treated according to the method already discussed (Table III) yield values of s and W of 198 and 0.79, respectively. The problem again arises as to whether the value of 0.79 is significantly different from zero. Here the distribution of W is such that the significance test may best be handled by the z test (*9*). Degrees of freedom are calculated as noted in Table V to obtain values for entry into the z table. If this process is carried out as shown in Table V, the value of z is seen to be 1.4 whereas the critical value, z_c, at the 5 per cent probability level of significance is found to be 0.6. It is therefore evident that the value of z obtained is greater than the critical value, that the concordance coefficient W is significantly different from zero and that therefore the rankings are statistically alike.

As a specific example of the application of the coefficient of concordance to data intended to demonstrate the possible means of selection of a test method or apparatus reference should be made to Table VI. Here six techniques for determining the evaluation of *handle* of fabrics by means of four different instruments used on ten fabrics are illustrated (*10, 11, 12, 13*).

Omitting for the present the first line of Table VI which is headed service tests, let us consider the remaining portion of the table. Applying the Kendall coefficient of concordance technique as already outlined, a value of $W = 0.56$ is obtained which when studied for significance gives a value of $z = 0.93$ as compared to a critical value z_c of 0.4 (5% probability level). This would indicate that the value W is significantly different from zero and that therefore the rankings are statistically alike.

Service Tests

The preceding discussion has been confined to the comparison of data from laboratory determinations entirely. A most important and a most bothersome question in modern textile technology is the establishment of a relationship between service tests and laboratory tests which purport to be either accelerated service tests or to show results similar to those obtained in service. In many cases service test results are not amenable to quantitative

TABLE V.—SIGNIFICANCE TEST FOR COTTON FINENESS RANKINGS.

	A	*B*	*C*	*D*	*E*	
Method I.......	2	5	4	1	3	
Method II......	1	5	3	2	4	
Method III.....	1	5	3	2	4	
Method IV.....	1	3	4	2	5	
Method V......	1	3	4	2	5	
u =	6	21	18	9	21	$\Sigma u = 75$
u^2 =	36	441	324	81	441	$\Sigma u^2 = 1323$

$s = 198$ $W = 0.79$

Significance Test

$$z = {}^1/_2 \log_e \frac{(m-1)W}{1-W}$$

D. of $F_{.1} = (n-1) - \frac{2}{m}$ D. of $F_{.2}$ = (D. of $F_{.1}$)$(m-1)$

$n = 5$ $m = 5$

$z = 1.4$ D. of $F_{.1} = 3.6$ D. of $F_{.2} = 14.4$

$z_c = 0.6$ (5% level)

Rankings are significantly alike.

TABLE VI.—SERVICE TEST CORRELATION.

Service Test ...	1	2	3	4	5	6	7	8	9	10	
Bending length.	1	5	2	3	4	7	6	8	9	10	
Rigidity.......	1	3	2	4	6	9	8	5	7	10	
Chord length...	1	2	10	3	4	8	9	6	7	5	
Radius of curvature.......	1	2	10	4	3	7	9	6	5	8	
Schiefer........	1	3	2	5	7	9	4	6	8	10	
Gurley..........	1	2	4	9	10	7	8	3	5	6	
u =	6	17	30	28	34	47	44	34	41	49	$\Sigma u = 330$
u^2 =	36	289	900	784	1156	2209	1936	1156	1681	2401	$\Sigma u^2 = 12\,548$

$n = 10$ $m = 6$

$s = 1658$ $W = 0.56$

$z = 0.93$ $z_c = 0.4$ (5% level)

Rankings are significantly alike.

study and are reported as ranks (or may be so reported). The question then arises as to which technique or piece of equipment is best suited to determine in the laboratory what results of service conditions may be. Again, reference to Table VI will indicate that a hypothetical service test ranking might be set up as indicated in the first line of the table and that this rank might be the information obtained from long-time service tests under controlled conditions or might well be the result of interlaboratory determinations. This simply adds one more ranking to the series and a new coefficient of concordance could be computed to indicate whether there was general agreement between the methods of test employed and the results of the service conditions.

Use of the rank correlation coefficient can be made in a more specific sense if a significant value of coefficient of concordance is obtained from a multiplicity of ranks including the rank depicting the behavior under service conditions. Each of the ranks from the different machines or instruments can be treated in conjunction with the service rank. The resulting coefficients will indicate by their algebraic magnitude the most efficient measure of correlation between the machine and the service rank. With these data at hand it is then possible to choose the machine most adequately depicting the results of service conditions and so predict what another sample of similar construction should experience when distributed to the ultimate consumer.

There are, of course, other considerations which should not be overlooked from the technician's point of view: which machine should be used from the consideration of time, cost, and ease of measurement? This problem, however, is beyond the scope of this discussion and resolves itself into a localized laboratory procedure best guided by the personnel and equipment available.

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Inquiry on Knowledge of Foreign Countries

A COMMUNICATION addressed to the Society from the Acting Secretary of the U. S. Department of Commerce indicates that the Federal Government is in need of specialized or unusual information concerning commodities used or produced abroad, and economic, industrial, and social conditions in foreign countries. With the communication was a form on which could be recorded information for the confidential use of the United States Government. In requesting this information, the inquiry form makes very clear that it is not an offer of employment. In the knowledge that a number of A.S.T.M. members and committee members have traveled or lived in foreign countries, this notice is published. The form can be obtained from A.S.T.M. Headquarters or direct from the Commercial Intelligence Unit, Bureau of Foreign and Domestic Commerce, Washington, D. C.

A.S.T.M. in Analytical Chemistry Courses

THE NOVEMBER ISSUE of the *Journal of Chemical Education* includes an interesting article by P. J. Elving, Purdue University, discussing "Texts for Courses in Technical Analysis." The author refers to the fact that "many students who enter industry after receiving a bachelor's degree are assigned to analytical work in which they use the methods devised and published by some official or standard-setting body such as the U. S. Bureau of Mines or the American Society for Testing Materials. Most chemists who enter research have occasion, more or less frequently, to use standardized procedures in connection with their work. An organic chemist, who has prepared a new compound which has possibilities as a solvent, would probably determine the flash and fire points, viscosity, and other technical constants. All of these individuals, teachers, students, research chemists, would have benefited from an introduction to the type of procedure given in an official method which usually is very different from the procedures with which they become acquainted in the elementary textbooks in quantitative analysis."

In another portion of the article he indicates that "in the author's courses the class cooperates to buy several copies of one or more textbooks or reference works to supplement the library facilities. In certain fields, the need for discussion of the procedures used is filled by the excellent monographs of the American Society for Testing Materials which interpret the results obtained in the examination of various classes of materials."

Following introductory discussion there is given a list of various publications under such heads as coal analysis, metallurgical analysis, tests of petroleum, spectrometric analysis, miscellaneous, in all of which there are brief descriptions of a number of A.S.T.M. publications, in particular the special technical symposiums and special compilations of A.S.T.M. standards. Members and others who may be interested in this article can purchase copies of the *Journal of Chemical Education* by addressing the publication office, Twentieth and Northampton Sts., Easton, Pa.

An Electrical Contact Testing Machine*

Project of Subcommittee on Contact Materials of Committee B-4

Prepared by A. M. Suggs[1]

Although electrical contacts are a vital part of much electrical equipment, there has never been a standard test procedure for evaluating different materials and types of contacts. Appreciating this fact, and in the light of a survey conducted by Mr. Dean Harvey, as Chairman of Committee B-4, among producers and users of contacts, a program to develop such a standard procedure and a suitable testing machine has been initiated in a newly formed Section B of Subcommittee II.

A number of additional representative men, producers and consumers of electrical contacts, were added to the committee and the work of developing a standard testing machine was undertaken. For more than two years the various phases of this subject have been studied. A preliminary machine was built by the Material Laboratory, Navy Department, which gave valuable information. Based on the experience with this machine, two other preliminary machines were made by the Gibson Electric Co. and P. R. Mallory and Co., Inc. They were given thorough tests, and the latter, with minor changes, was selected. By the end of 1941, ten machines were manufactured and were purchased by members.

A series of preliminary tests, using fine silver contacts under certain specified conditions, has been completed with encouraging results. Further tests are now under way.

In 1942, the section was reorganized into a separate Subcommittee X so that the work could be carried on more effectively.

This paper is intended to describe the construction and the principle of operation of the machine, with typical test data as an illustration of the type of information obtainable.

Description of the Machine

Principle of Operation:

Figure 1 shows the general appearance of the Contact Testing Machine, which consists principally of three units of mechanism for opening and closing electrical contacts, with the necessary auxiliary equipment for making measurements of the operating characteristics of the contacts. Each unit mechanism has provision for mounting a pair of test contacts; thus three pairs of contacts can be tested at the same time.

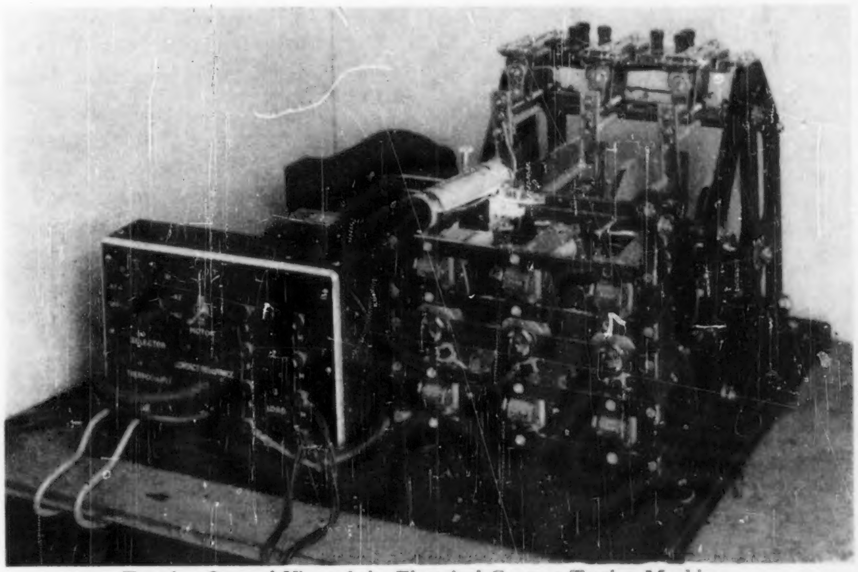

Fig. 1.—General View of the Electrical Contact Testing Machine.

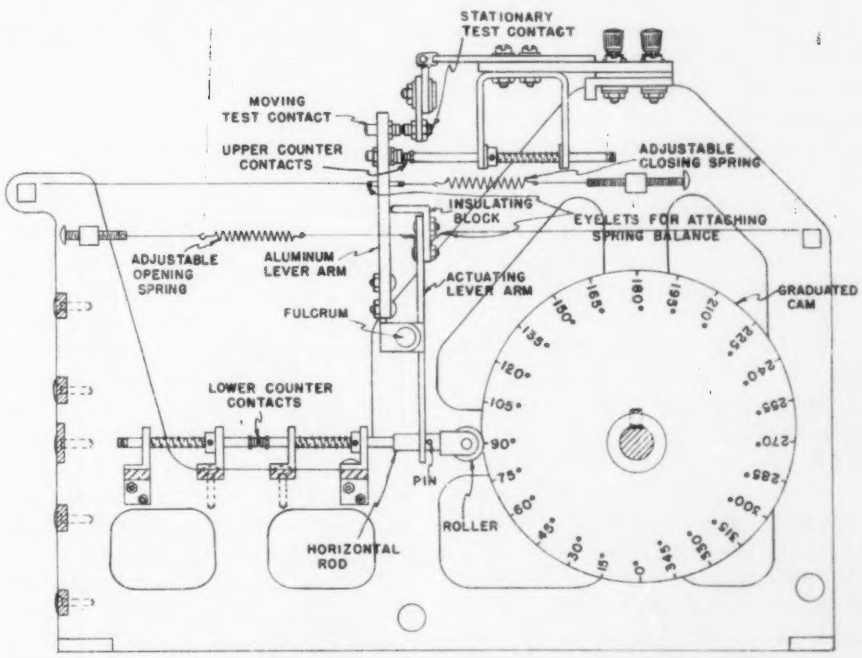

Fig. 2.—Schematic Side View of the Contact Making and Breaking Mechanism of the Electrical Contact Testing Machine.

NOTE.—DISCUSSION OF THIS PAPER IS INVITED, either for publication or for the attention of the author. Address all communications to A.S.T.M. Headquarters, 260 S. Broad St., Philadelphia, Pa.

* This paper also appears in the A.S.T.M. Standards on Electrical-Heating and Resistance Alloys, p. 108, the same type being used in this Bulletin. (Issued as separate publication.)

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Make-and-Break Mechanism:

In selecting a method for making and breaking a set of contacts, several methods are available, such as those found in electrical relays, solenoids, bimetal thermostats, pressure bellows and various mechanical arrangements. After considering the advantages and disadvantages of several methods, it was decided that a mechanical make-and-break arrangement should be used, since in such a system the rate of make and break can be more easily determined, the bounce characteristics in general vary less, and the force acting at the contacts is likely to be measured more easily and remain more constant during a test. A greater degree of similarity in the construction of a number of contact testing mechanisms is also more easily attained in mechanical apparatus.

The making and breaking of the contacts on the machine, as it was finally designed, was obtained by a lever and cam movement. A diagram of this arrangement is shown in Fig. 2. In each set of test contacts, the stationary one is mounted in a stationary bracket, which has provisions for vertical, horizontal and coaxial alignment of the contacts. The moving contact is mounted on one end of a vertical aluminum lever arm, 4 in. above the fulcrum. This arm is actuated by a second lever, both levers having a common fulcrum. An insulating block on the second lever $2\frac{1}{2}$ in. above the fulcrum rides against the first lever and provides the connection through which the second actuates the first. A horizontal rod is made to follow the cam by the action of a spring. A pin through this rod rides against the second lever at a point 2 in. below the fulcrum. The friction of the rod riding against the cam is reduced by a roller which rides on the cam. The levers are under action of adjustable coil springs, which become effective as the cam rotates and reduces the pressure of the pin against the actuating lever arm.

The cam shaft is connected through a pulley and belt system and reduction gear to a $\frac{1}{12}$-hp., 115-v., a-c. motor. The pulleys supplied with the machine give a rate of rotation of the cams of 60 rpm. With other pulleys this might be varied over the approximate range of from 20 to 200 rpm.

The cams are 6-in. round disks, $\frac{5}{16}$ in. thick, with the center of rotation $\frac{1}{4}$ in. from the center of the disk. The maximum rise of the cam is $\frac{1}{2}$ in. and thus the maximum motion of the moving contact is 1 in.

The cams are marked for each 15 deg., in order that the phase relation of the cams can be set. By varying the points on the cam at which the contacts open and close, the rate of opening and closing can be varied over the approximate range of 0.5 to 3 in. per second, with the cams rotating at 60 rpm. With circular cams the rate of make is always the same as the rate of break.

By shifting the phase relation of the three arms, a set of contacts can be made either to break, make, or make and break the load being used. Thus it is possible on the machine to have one set of contacts make, another break, and the third make and break.

Contact Forces:

The forces acting at each set of contacts are provided by two adjustable coil springs.[2] The spring which closes the contacts is fastened to the back of the moving contact arm, 1 in. below the contact. The force acting at the contacts, due to this spring, is reduced by the ratio of 4:3. The opening force is obtained from a spring fastened to the actuating lever 2 in. above the fulcrum and extending in the opposite direction from the spring that closes the contacts.

The opening spring must be stronger than the closing spring since, as the contacts open, it must overcome the pull of the closing spring and, in addition, supply the necessary opening force. In the closed position the force of the opening spring is taken up by the actuating arm and does not act on the arm which holds the moving contact. Since the opening spring is mounted at a point half way between the contact and the fulcrum, the force acting at the contacts due to this spring is reduced by the ratio of 4:2. Thus the closing force at the contacts is three-fourths of the force exerted by the closing spring. The opening force is the difference between one half the force of the opening spring and the closing force. By using various springs these forces are adjustable from 30 to 500 g., but the accuracy is less at forces of about 30 g.

A special spring scale, shown mounted on the testing machine in Fig. 1, was designed for use on the machine for measuring contact forces. Arrangements are provided on the machine for attaching the scale to the levers opposite the two springs which control the contact forces, which can thus be measured directly and the resulting contact forces calculated. The scale can also be used to measure the force required to open welded contacts, if this value does not exceed approximately 300 g.

Control Panel:

The control panel is located at the left of the machine (Fig. 1). On the right of the panel are found the load outlets to the three sets of contacts. These outlets are connected directly to the moving or stationary contacts of each position as indicated on the panel. With this arrangement it is possible to connect the contacts either to separate loads or to a common load. Under the load outlets are two outlets for connecting the cutout in series with the load leads. The function of this cutout will be explained later.

At the left of the panel at the top is a multi-position selector switch which is used to connect a suitable instrument for the temperature and contact resistance measurements. This provides means of measuring the ambient temperature, the temperature of each stationary contact, and the contact resistance of each set of contacts. In the lower left corner are outlets for connecting a 12-v. d-c. source which is needed for an auxiliary counter circuit.

Method of Indicating Contact Welding:

The machine is equipped with one mechanical and six electrical counters which are used for determining the number of operations and the number of welds for each position. The mechanical counter is connected to the cam drive shaft and counts each revolution of the machine.

In the upper left of Fig. 3 is found a schematic wiring diagram of the

[2] Springs for operating certain counter contacts introduce small opening forces which will be neglected in the following discussion. However, since only resultant forces are measured, all forces are accounted for in the calculated contact forecs.

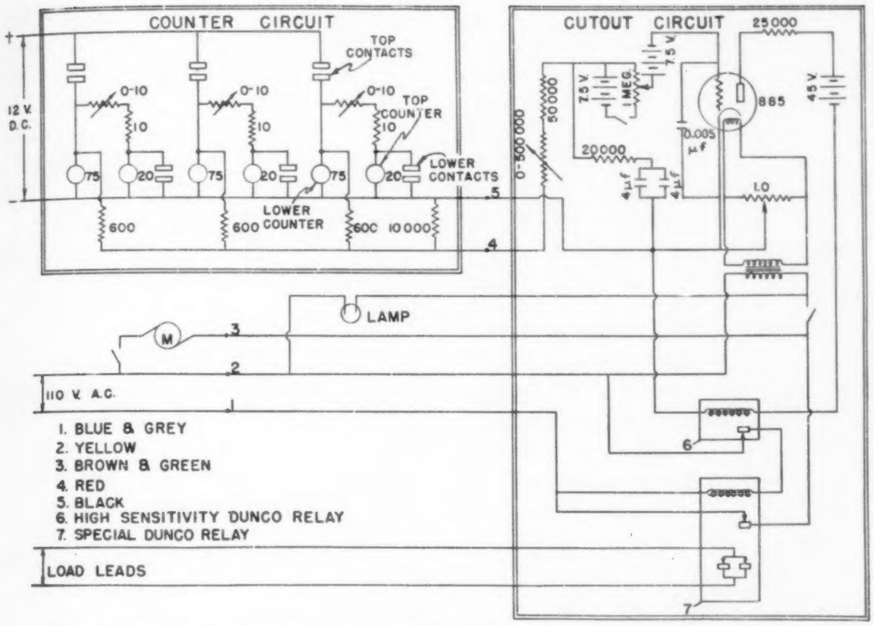


FIG. 3.—Circuit Diagram Showing the Wiring of the Counter System and Electronic Cutout Device of the Electrical Contact Testing Machine.

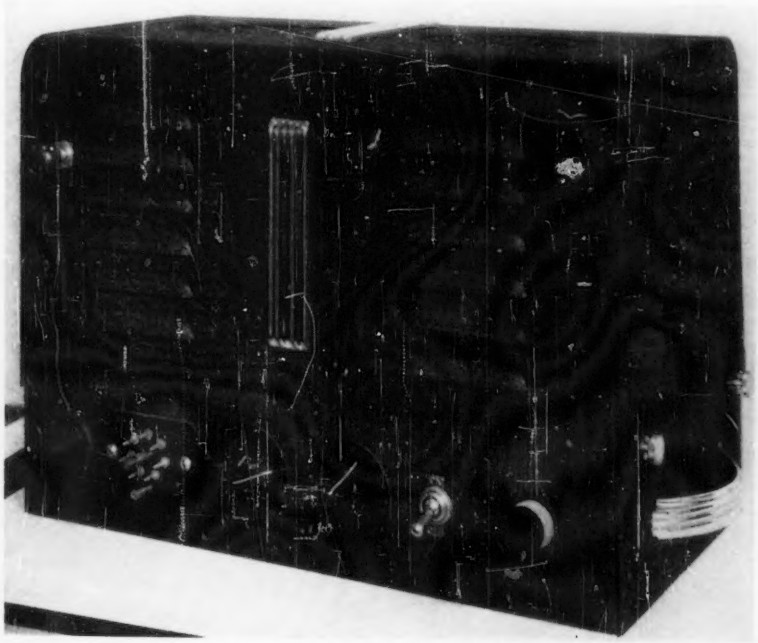


FIG. 4.—Electronic Cutout Device for the Electrical Contact Testing Machine.

electrical counter system. The counters are identified in the circuit by their ohmic resistance, the 75-ohm counters being in the bottom row on the front of the machine, and the 20-ohm counters being in the top row.

The top counter contacts are located ½ in. under the test contacts, and these two sets operate together so that each time the test contacts make and break, a count is recorded on the corresponding bottom counter. In case of a weld on the test contacts, the top counter contacts are held in a closed position, the counter remains energized and thus fails to count.

On the horizontal shafts which drive the actuating levers are located the sets of contacts indicated on the drawing as the "lower contacts," which open and close for each revolution of the machine. These operate in conjunction with the upper row of counters to record the number of welds and sticks for each position. A weld is defined as one that requires a force in excess of the opening force to break it and that lasts for the number of complete revolutions of the machine for which the cutout is set to operate. A stick is a partial weld which will not last long enough to stop the machine.

In normal operation, when the test contacts are not welding, the upper and lower counter contacts are closed at the same time so that the lower counter is energized but the upper counter is shunted by the lower counter contacts, and thus is not operated. However, if the upper counter contacts are held together by the welding of the test contacts until the lower counter contacts open, the upper counter is then energized and a weld is recorded. If the weld breaks before the completion of the revolution, the lower counter may also be actuated. Thus, there are three different ways that the counters may operate:

1. In normal operation with no welding, the lower counters record each operation of the contacts and the upper counters do not operate.

2. In case of welds, the lower counters stop and the upper ones begin to count the revolutions, during which the contacts are welded until the machine stops.

3. In case of sticks, the upper counter contacts are held closed, actuating the upper counters, and then break without stopping the machine, when the test contacts separate.

From the counters it is possible to determine the following for each position:

1. Number of times the test contacts would operate if there were no failures.

2. Number of times the test contacts actually operate.

3. Number of cycles lost due to test contacts sticking and welding.

Electronic Cutout for Load and Motor:

The Contact Testing Machine was supplied with an electronic cutout device for stopping the machine and opening the load circuit in case of a failure of any of the test contacts by welding. A photograph of this device is shown in Fig. 4, and its schematic wiring diagram is on the right of Fig. 3. The cutout consists of two relays and a Thyratron with its voltage supplies. One of the relays has high sensitivity in order to operate from

the tube with low current drain, and the other is a heavy-duty relay for opening and closing the load and motor circuits.

In operation the grid bias of the Thyratron is adjusted, while the machine is running, to a value just under the firing potential by means of the potentiometer across one of the 7.5-v. batteries in the grid circuit. When any of the three sets of contacts weld, the potential between points 4 and 5 increases and a charge begins to leak onto the two 4 μf condensers and the grid voltage is raised to the firing point. The rate at which the condensers are charged and, consequently, the rate at which the grid potential is raised, is adjustable by means of the variable resistor in the circuit. This gives a continuously variable delay over a limited range between the time the contacts weld and the time the heavy-duty relay is actuated by the firing of the Thyratron. The delay can be varied from 1 to approximately 10 sec.

The nature of the Thyratron is such that when the grid is sufficiently negative the tube passes practically no current. As the grid becomes more positive at a very critical potential, the tube "breaks down," the grid loses control and the tube can pass a relatively large current with low voltage drop. For the 885 tube used in this circuit, this drop is approximately 16 v. and is practically constant for a wide range of currents.

When the tube fires or "breaks down," the increase in plate current actuates the sensitive relay and causes its normally open contacts to close. When these contacts close, the heavy-duty relay is energized and the three sets of contacts on this relay that are normally closed, are opened and held open by a latch-out attachment. Two of the three sets of contacts are in parallel and are used to open the load line. Since provisions are made for opening only one line, the three sets of test contacts must have a common load, if the load is to be removed from all contacts. With separate loads for the contacts, the cutout can be used to stop the machine, but not to disconnect the load. The third set of contacts on the heavy-duty relay opens the motor circuit and the primary of the filament transformer when the coil is energized.

On the front of the cutout unit, shown in Fig. 4, the following controls are found:

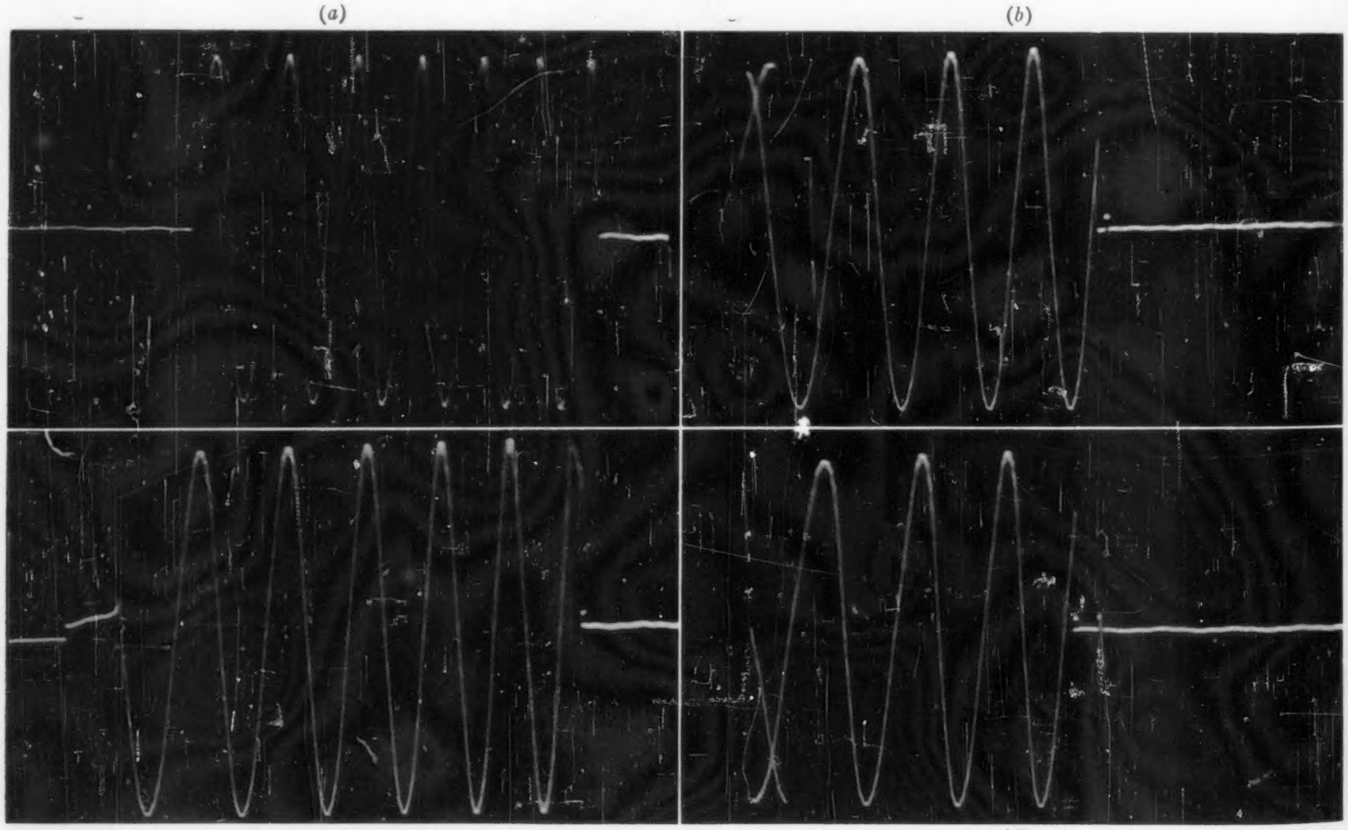
1. Reset button which releases latch-out mechanism.
2. A seven-wire cable for connecting voltage supplies and motor control leads to the cutout.
3. A 0 to $\frac{1}{2}$ megohm variable resistor for varying charging rate of condensers.
4. A 1 megohm potentiometer for varying the grid bias.
5. A double-pole single-throw, off-on switch for the filament transformer and the battery in the grid circuit.
6. A plug-in outlet for a low wattage lamp or other signalling device for indicating when the machine is operating. This lamp or other device is turned off when the heavy-duty relays open the load and motor circuits.

Performance of the Machine

Oscilloscopic Study:

It is generally known that the bounce characteristics of any actuating mechanism have considerable effect on the operation of the contacts. In general, the bouncing of contacts, especially at the make, is quite detri-

(*a*) (*b*)



(*c*) (*d*)

Fig. 5.—Oscillograms Showing the Making and Breaking of Test Contacts Taken on the Electrical Contact Testing Machine.

mental to the contacts and may be the cause of early failure due to high resistance, over-heating, excessive transfer on d-c. applications, or welding.

Since bouncing of the contacts, often referred to as chatter, can have so much effect on their operation, it is quite important in making a fundamental study of contacts to know the bounce characteristics of the actuating mechanism. With the aid of an oscilloscope, some observations of bounce were made on the original Contact Test Machine at P. R. Mallory and Company, Inc., and some representative results are shown in Fig. 5.

In Fig. 5 (*a*) is a trace showing the break at the left end of the sine wave, and the make at the right end of the sine wave. The horizontal line indicates zero voltage across the contacts and, therefore, represents closed contacts. During these operations the contacts were operating at 110 v. a-c. and about 18 amp. resistive load. The closing force was 100 g., the opening force 75 g., and the rate of make and break $1\frac{1}{2}$ in. per sec. Figure 5 (*a*) shows the break on one set of contacts and the make on another, since a successive break and make does not occur on the same set of contacts in normal operation.

On this trace there is no indication of an arc at the break or any bouncing at the make. The contacts started to open as the a-c. voltage was passing through zero and so no arc was established. On the right end of the sine wave the voltage drops suddenly to zero and since there is no break in the horizontal line, the contacts did not reopen after closing.

Figure 5 (*b*) shows a typical bounce. At the right end of the sine wave the voltage drops to zero and the break in the horizontal line a fraction of a second later shows that the contacts opened again with an arc stage existing during this open period. In all operations which were observed during this study there was no definite indication that more than one such bounce occurred in a cycle, but at other times two bounces have been observed occasionally.

Figure 5 (*c*) shows a trace which indicates a heavy arc period when the contacts open. This is shown by the slanting line at the left of the sine wave. For this particular break, the arc lasted for nearly one-half cycle. The duration of the arc as well as its intensity depends on the point of the current cycle at the instant the contacts begin to separate.

The small point just above the beginning of the horizontal line at the right represents a phenomenon which had not been observed when the oscilloscopic trace was visually inspected. This point does not represent a bounce since the horizontal line shows that the contacts had not been closed. A possible explanation is that the point represents the breakdown of a fairly high-resistant surface film. As the contacts close, the first contact is made with very low closing force which is insufficient to disrupt this surface film. Possibly by a combination of high voltage, high current density and increased closing force, the film is broken and the voltage across the contacts drops to zero.

Figure 5 (*d*) shows what occurs when there is a combination of a breakdown of the surface film and a bounce. The bounce occurs just before the voltage passes through zero and the arc which is established at the bounce is extinguished very quickly. The contacts are still open after the arc goes out, so that a small segment of the a-c. voltage wave is shown on the trace at the opening of the contacts caused by the bounce.

In this study about fifty pictures were made and the indications are that on this particular machine one bounce occurs about half the time, and the remainder of the time the contacts close with no indication of a bounce.

Approximately one-fourth of the pictures showed the breakdown of the surface film. The contacts at this time had operated fewer than 5000 times.

Results of a Typical Test:

The following is quoted from a progress report made on a test being conducted on the Machine at the General Electric Co., Schenectady, N. Y. The test was conducted and reported by C. H. Chapman of the above company.

"A test was run on fine silver tips to determine the relationship between the load current and the tendency to weld. The tips used were 99.95 per cent silver and 0.05 per cent copper. The silver tip facings on the ends of the supporting screws were $\frac{1}{4}$ in. in diameter and about $\frac{3}{32}$ in. in thickness. The tips had a crown of 1-in. radius on both movable and stationary tips.

"The testing conditions were set to give a closing and opening speed of the movable tip of about $1\frac{1}{3}$ in. per sec. at the instant of make and break of the circuit. The closing force was adjusted to a value of 100 g. at the tips, and the opening force was set to a value of 25 g. at the tips.

"Tendencies to weld slightly for amounts below this opening force of 25 g. will, therefore, not be detected as the opening force will break all welds of less than 25 g. in weight. However, some of the welds are of such a value that they hold on long enough to cause an operation of the weld counters on the A.S.T.M. tip-testing machine, but yet do not remain welded until the machine can be turned to a position for determining the force necessary to break the weld by using a spring balance. Such welds, that hold momentarily and then break under the force of the opening spring only, are designated as "sticks." Quite a percentage of the total number of operations of the weld recording counters are due to these "sticks."

"Taking a total number of 50,000 operations on each of three sets of tips as a figure for making a comparison, the total number of sticks and welds, the total number of welds, and the average force necessary to break the welds for four different values of load current handled were determined. These data are listed below:

Current values, amp.	22	20	18	16
Total, sticks and welds	62	30	12	2
Welds only	41	18	5	1
Average force to break welds, g.	121	95.3	70.3	102
Percentage of sticks that are welds	66.1	60.0	41.7	50.0
Operations per stick	806	1667	4170	25 000
Operations per weld	1220	2780	10 000	50 000

"The test was started at 22 amp. with new tips. For the succeeding runs of 20, 18, and 16 amp., the tips were reconditioned by first filing off the burned, oxidized, and pitted portion of the contact surfaces, then by crowning the tips to about the same radius as before, and finally by polishing the contact surface on a buffer wheel.

"The results would indicate that at a value of current of 15 amp., or slightly less, no sticking or welding would be expected with the conditions of operation set for 100 g. closing force, 25 g. opening force, and a speed of closing and of opening of $1\frac{1}{3}$ in. per sec."

The preceding excerpt from this report is included to show a typical test for which the machine can be

used. Other tests with identical setting on various machines have shown that similar results are obtained in the several laboratories. From tests conducted to date it seems reasonable to assume that results from different laboratories are comparable and that no appreciable variations in test results will be encountered due to differences in the machines, provided care is used in adjusting the machines to the specified test conditions.

Summary of Measurements and Range of Adjustments:

In the foregoing descriptions of the various parts of the Contact Testing Machine, the adjustments and measurements as connected with each part have been mentioned. A typical test has been included to show that the machine gives results consistent with variations in test conditions. The following is included to summarize briefly in one section the various measurements that can be made on the machine and the range of the adjustments.

For a test on a given contact material the following factors can be determined:

1. Contact resistance.
2. Stationary contact temperature rise during operation.
3. Force to open welded contacts.
4. Change in over-all dimensions of contacts during or at the end of the test, and the change in dimension of individual contacts at the end of the test.
5. Welding and sticking characteristics of the material under the particular test conditions.
6. The effect of either making, breaking, or making and breaking on the contact performance.
7. Change in weight can be determined by weighing contacts before and after a test.

The various adjustments that can be made on the machine and their range are as follows:

1. The wiring and insulation will allow the machine to operate at current from 0 to 50 amp. and voltages from 0 to 220 a.c. or d.c. with inductive, capacitive or resistive loads.
2. The contact forces, opening and closing, can be varied from 30 to 500 g.
3. The velocity of the contacts at make and break is variable from 0.5 to 3 in. per sec. at 60 rpm. cam speed.
4. The frequency of operation can be made, by the use of extra pulleys, to cover the range from 20 to 200 operations per minute.
5. The machine can be used to test contacts from $\frac{1}{8}$ to $\frac{1}{2}$ in. in diameter.
6. The cutout can be made to stop the machine after from 1 to 10 welded cycles.

A.A.S.H.O. Standards for Highway Materials

The new edition of the American Association of State Highway Officials book of standard specifications for highway materials has been issued in two parts. Part I of this fourth edition includes the 102 specifications, while Part II gives the 103 methods of sampling and testing. The committee on materials responsible for the standards given in this publication is headed by H. S. Mattimore, Engineer of Materials, Penna. State Highway Dept., and F. H. Jackson, Senior Engineer of Tests, Public Roads Administration, Secretary of the committee.

Many members of the Association are active in A.S.T.M. work, and the following excerpts from the introduction to the book are significant, showing the relation of A.S.T.M. standardization with A.A.S.H.O.:

"The Association continues to utilize, in so far as possible, various applicable standards of the American Society for Testing Materials, and wishes again to express its appreciation for permission to publish those A.S.T.M. standards which it has adopted. As noted above, the committee has included in the current edition a number of A.S.T.M. standards for materials used in bridge construction. These were previously covered by reference only in the Association "Standard Specifications for Highway Bridges." In the case of these standards as well as in all other cases where the technical requirements of the Association and A.S.T.M. specifications are identical, reference to the A.S.T.M. designation is given in parentheses immediately below the Association designation.

"The committee recognizes that, at least in so far as methods of testing are concerned, every effort should be made to reconcile its procedures with those of the A.S.T.M. With this thought in mind it quite recently reviewed all of its methods of testing for the specific purpose of substituting for them, wherever possible, the corresponding A.S.T.M. procedures. This action has resulted in the adoption by the Association of A.S.T.M. test methods in a majority of cases, an action which should considerably simplify the use of these specifications by the various agencies engaged in the production and testing of road materials. In certain other methods the text of the Association standard differs only slightly from that of the A.S.T.M., or may include minor but important additions to the procedure adopted by the Society. In these cases it has been necessary to omit reference to the A.S.T.M. designations. In addition, there are a number of Association methods which have no equivalent in the standards of the A.S.T.M."

Each part of the book includes a table of contents arranged by materials, and also a list in numerical sequence. Copies of this publication may be obtained from the General Offices of the Association, 1220 National Press Building, Washington, D. C., priced at $4.50 per set.

Emergency Specifications for Traffic Paint

Emergency Alternate Specifications for Paint: Traffic, Exterior, White and Yellow, E-TT-P-115, have been issued by the National Bureau of Standards for the purpose of standardizing a satisfactory quality of paints made from the natural resins recently made available for this purpose. Until the amendment to WPB Order M-56, restrictions on both natural and synthetic resins had reduced the properties of the paints to the point where undue waste of pigments was being encountered.

Paint for traffic markings and other similar purposes is essential to proper movement of traffic. When the use of the two natural resins, batu gum and congo copal gum was restricted by M-56, considerable ingenuity was shown by paint manufacturers in providing substitutes. Subsequently, the supply of these two resins became easier, so an amendment was issued permitting the use of one pound or less of batu gum, or two pounds of congo copal gum, or both, per gallon of paint.

Copies of the specifications may be obtained from the National Bureau of Standards, Washington, D. C., or from the Protective Coatings and Materials Section, Chemicals Branch, War Production Board, Railroad Retirement Building, Washington, D. C.

A Representative Bibliography of Silicon Bronze

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Re. 19,915—John R. Freeman, assigned to American Brass Co., April 7, 1936.

Die-casting alloy containing additions of silicon, with lead, aluminum, zinc, and tin. Range: 59 to 61 per cent copper, 0.5 to 1.5 per cent tin, 0.5 to 1.5 per cent lead, 0.05 to 0.15 per cent aluminum, 0.1 to 0.2 per cent silicon, remainder zinc. Also 60.00 per cent copper, 37.75 per cent zinc, 1.00 per cent lead, 0.15 per cent silicon, 0.10 per cent aluminum.

1,539,260—Charles B. Jacobs, assigned to E. I. du Pont de Nemours and Co., May 26, 1925.

Copper-base alloys containing from 3 to 15 per cent of silicon, and from 0.5 to 3 per cent of manganese, remainder copper. Defined as copper-silicon-manganese alloys in which the copper predominates, and in which the proportion of silicon is a multiple of the proportion of manganese.

1,658,186—M. G. Corson, February 7, 1928.

Copper alloy. An alloy consisting mainly of copper and which contains silicon and may be hardened with chromium, cobalt, or nickel, is homogenized at a high temperature to effect solution of substantial quantities of silicon and hardening metal; after quenching the material is reheated to 250 to 600 C. to effect a hardening, and is then cooled.

1,686,679—Richard A. Wilkins, assigned to Revere Copper and Brass, Inc., July 26, 1932.

Copper-tin-silicon-zinc alloys typified by 90 per cent copper, 3.25 per

cent silicon, 0.5 per cent tin, remainder zinc. Ranges: 85 to 95 per cent copper; 0.25 to 4 per cent silicon, 0.25 to 5 per cent tin, remainder zinc.

1,692,936—Friedrich Heusler, November 27, 1929.
Copper alloys. In order to increase the hardness and elastic limit of alloys of copper containing 0.5 to 20 per cent manganese and 0.3 to 8 per cent silicon, the alloys are first annealed, after they have been cast, rolled, or forged, at a temperature above 450 C., then cooled and finally hardened at a temperature of 200 to 350 C.

1,729,208—Michael G. Corson, assigned to Electro Metallurgical Co., September 24, 1929.
Copper-base alloys containing silicon. Copper-base alloys containing 3.7 to 6.7 per cent silicon are subjected to heat treatment at 500 to 800 C. to secure a homogeneous composition of copper and silicon which will be supersaturated at room temperature; the alloy is quenched from a temperature within the range mentioned to preserve such conditions of solid solution. Alloys thus treated are of improved resistance to corrosion.

1,777,174—Walter Machin and William Bouch O'Brien Goudielock (England), assigned to P-M-G Metal Trust Ltd. of London, September 30, 1930.
Refers to a method of improving copper alloys by use of a hardener or pre-alloy which contains silicon, iron (preferably cast iron or iron prepared from a mixture of steel and cast iron) and copper, with or without phosphorus. Range: 5 to 30 per cent iron, 10 to 70 per cent silicon, not less than 20 per cent copper. Methods of heat treating and alloying. This pre-alloy is further melted with copper.

1,777,192—Udo de Berker, Walter Machin, and William Bouch O'Brien Goudielock (England), assigned to P-M-G Metal Trust, Ltd., of London, September 30, 1930.
Refers to manufacture of copper-base alloys containing iron by using silicon with or without the addition of phosphorus, using the hardener containing up to 5 per cent silicon, and up to 70 per cent iron, with 20 to 60 per cent copper.

1,792,944—Eugen Vaders (Germany), February 17, 1931.
Copper alloys containing also silicon, nickel, iron, and zinc. Casting alloys suitable for tools are formed mainly of copper, together with 1 to 4 per cent silicon, 1 to 5 per cent nickel, 4 to 6 per cent iron, and 8 to 20 per cent zinc.

1,848,857—Louis P. Webert, assigned to American Brass Co., March 8, 1932.
Copper-silicon-zinc alloys. An alloy which is resistant to acids, etc., comprises copper together with 1.0 to 4.5 per cent silicon, 1 to 15 per cent zinc, 0.1 to 0.5 per cent manganese.

1,848,858—Louis P. Webert, assigned to American Brass Co., March 8, 1932.
Copper-silicon alloys containing both zinc and aluminum. Ranges: 1.0 to 4.5 per cent silicon; 1.0 to 10 per cent zinc; 0.5 to 6 per cent aluminum; 0.0 to 1.5 per cent manganese, remainder copper.

1,915,999—Herbert C. Jennison, assigned to American Brass Co., June 27, 1933.
Copper-base alloy which can be hard drawn. Range: approximately 8.0 per cent zinc, 0.7 per cent silicon, 0.15 per cent manganese, remainder copper, with silicon varying from 0.01 to 0.95 per cent, zinc from 6.5 to 13 per cent, manganese from 0.01 to 1.5 per cent, remainder copper.

1,916,000—Herbert C. Jennison, assigned to American Brass Co., June 27, 1933.
Alloy for hard drawing, containing 0.01 to 2 per cent cadmium, 0.01 to 3.5 per cent silicon, 1.0 to 15 per cent zinc, 0.01 to 3.5 per cent manganese, remainder copper. Aluminum may be added from 0.01 to 6.0 per cent. Objectives include good electrical conductivity, high strength, hardness, chiefly for wire drawing.

1,916,001—Herbert C. Jennison, assigned to American Brass Co., June 27, 1933.
Copper-b[illegible] alloy of good electrical conductivity and hot-working properties. Range: 0.10 to 0.90 per cent silicon, 1 to 10 per cent zinc, 0.10 to 1.0 per cent manganese, 0.10 to 0.40 per cent aluminum, remainder copper. For extruding, hot forging, and hot pressing, as well as cold-drawn wire.

1,919,725—Herbert C. Jennison, assigned to American Brass Co., July 25, 1933.
Copper alloys. Alloys which are suitable for electrical conductors comprise copper together with 1 to 15 per cent zinc, 0.1 to 3.5 per cent silicon, 0.1 to 3.5 per cent manganese, 0.1 to 2.0 per cent cadmium, and 0.1 to 6.0 per cent aluminum. Relates to Jennison's other and prior inventions.

1,924,581—Richard A. Wilkins, assigned to Revere Copper and Brass, Inc., August 29, 1933.
Refers to previous invention and continuation of heat-treatable high-copper alloys containing 88 to 93 per cent copper, 0.1 to 0.6 per cent iron, 0.4 to 5 per cent silicon, 2 to 10 per cent zinc.

1,954,003—Eugene Vaders (Germany), April 10, 1934.
Copper-silicon-zinc alloys containing 65 to 94 per cent copper, 6 to 2 per cent silicon, 28 to 3 per cent zinc. For selected properties, other metals may be added, not to exceed 2 per cent, for chill and die casting.

1,933,390—Kenneth W. Ray and Howard W. Gould, assigned to the American Brass Co., October 31, 1933.
Copper-zinc-silicon alloy which can readily be cast and worked. Range (different combinations): 0.5 to 6 per cent silicon, 1 to 19 per cent zinc, 85.5 to 88 per cent copper. Small amounts of tin, aluminum, chromium, manganese, or other metals may be present.

1,936,397—Herbert C. Jennison, assigned to American Brass Co., November 21, 1933.
Copper alloys containing silicon and manganese for hardness, workability, toughness, etc. Alloys which have good strength and workability are formed of copper, together with 0.1 to 2.5 per cent silicon, and 0.01 to 0.4 per cent manganese. As a substitute for many copper-zinc alloys, for both wrought and cast requirements.

1,956,251—William B. Price, assigned to Scovill Manufacturing Co., April 24, 1934.
Copper alloys. Alloys which are resistant to salt water comprise copper together with 1.0 to 3.25 per cent silicon, 0.5 to 1.5 per cent tin, 0.75 to 1.27 per cent iron, and 0.15 to 0.50 per cent impurities.

1,959,509—Sam Tour, assigned to Lucius Pitkin, Inc., May 22, 1934.
Alloy containing bismuth as well as silicon, zinc, copper, and other metals such as iron, manganese, nickel, cobalt; objective, increased machinability. Range: 0.0 to 6 per cent silicon, 1 to 6 per cent bismuth, 0.1 to 35 per cent zinc, 0.1 to 6 per cent of metals in the group consisting of iron, manganese, nickel, and cobalt.

1,962,637—Donald K. Crampton and Henry L. Burghoff, assigned to Chase Co., Inc., June 12, 1934.
Copper alloys. Alloys that are resistant to cracking during hot working and that are both freely hot-workable and capable of being given a high tensile strength by cold working contain 95 per cent copper or m[illegible] together with 2.75 to 3.25 per cent silicon and 0.5 to 1.25 per cent zi[illegible] always less than half the amount of the silicon).

1,987,639—Robert T. Roberts, assigned to Western Electric Co., Inc., January 15, 1935.
Leaded brass alloy containing lead up to 0.5 per cent with silicon up to about 2 per cent, for increased hot-rolling properties and workability.

2,002,460—Richard A. Wilkins, assigned to Revere Copper and Brass, Inc., May 21, 1935.
Substantially zincless copper-base alloys, which can be worked both hot and cold, and which can be heat-treated at temperatures below recrystallization temperatures to increase the yield point without reduction in tensile strength and ductility. Range: 2.25 to 3.5 per cent silicon, 0.25 to 2.0 per cent tin (the maximum amount of tin being 1.8 to 2.0 per cent and varying linearly and directly when the silicon is 2.25 to 3.0 per cent and varying between 1.7 and 2.0 per cent linearly and inversely with the silicon when the latter is 2.0 to 3.0 per cent), remainder copper.

2,017,025—Edward S. Cornell, Jr., assigned to American Radiator Co., October 8, 1935.
Silicon-iron-phosphorus-copper alloys with enhanced workability imparted by phosphorus and iron. Alloys suitable for casting and which can be welded substantially without pitting, and have a tensile strength of at least about 60,000 psi., and a melting point of about 1040 C. Range: Copper, together with 2.0 to 2.75 silicon, 0.10 to 0.15 per cent iron, 0.01 to 0.02 per cent phosphorus.

2,034,563—Charles H. Davis and Cyril Stanley Smith, assigned to American Brass Co., March 17, 1936.
Copper-silicon-cadmium alloys having improved tensile strength and casting properties because of cadmium additions. Range: 0.5 to 5 per cent silicon, 0.05 to 1.5 per cent cadmium, balance copper, with some sulfur and lead.

2,035,414—Richard A. Wilkins, assigned to Revere Copper and Brass, Inc., March 24, 1936.
Copper-base alloys suitable for working either hot or cold. Refers to addition of iron to ternary copper-silicon-tin alloys for corrosion resistance and high workability. Small amounts of other metals permissible. Range: 2 to 3.5 per cent silicon, 0.25 to 2.0 per cent tin, 0.1 to 0.6 per cent iron, remainder copper.

2,035,415—Richard A. Wilkins, assigned to Revere Copper and Brass, Inc., March 24, 1936.
Relates to alloys of copper together with 2.0 to 4.5 per cent silicon, 0.25 to 2.0 per cent tin, 0.1 to 0 6 per cent iron, and up to 7.65 per cent zinc, in certain specified relative proportions to each other to give high strength, ductility and good heat treating properties. Such alloys are suitable for mechanical working and heat treatment.

2,038,137—Cyril Stanley Smith, assigned to American Brass Co., April 21, 1936.
Copper-silicon-selenium alloys with high machinability. Range: 0.25 to 5.0 per cent silicon, 0.05 to 2 per cent seleniun, with suitable additions of zinc, tin, and iron.

2,049,449—Herbert C. Jennison, assigned to American Brass Co., August 4, 1936.
Welded products of copper-mangnaese-silicon alloys. Structures such as tubes or cylinders, etc., are formed of members composed of an alloy of copper with up to 3 per cent manganese, and 0.35 to 10 per cent silicon, and welded together with an alloy of about the same composition.

2,062,448—Louis S. Deitz, Jr., and Hanley H. Weiser, assigned to Nassau Smelting and Refining Co., December 1, 1936.
Silicon-tin bronze of high ductility and corrosion resistance. Range:

copper, with 2.50 to 3.25 per cent silicon, 0.50 to 1.25 per cent tin, 0.01 to 0.60 per cent manganese.

2,075,004—William H. Bassett, assigned to American Brass Co., March 30, 1937.
Copper-silicon-zinc-tin-lead alloy with free-cutting properties. Range: 0.1 to 6.5 per cent silicon, 1 to 12 per cent zinc, 0.5 to 6 per cent tin, 0.1 to 0.45 per cent lead, remainder copper.

2,075,005—William H. Bassett, assigned to American Brass Co., March 30, 1937.
Copper-silicon-zinc-lead alloys of good free-cutting properties. Range: 0.1 to 6.5 per cent silicon, 1 to 12 per cent zinc, 0.25 to 0.4 per cent lead, balance copper.

2,075,014—William H. Bassett, assigned to American Brass Co., March 30, 1937.
Copper-silicon alloys having free-cutting properties and which are resistant to corrosion. Range: 0.1 to 6.5 per cent silicon, 0.01 to 3.0 per cent manganese, 0.1 to 0.45 per cent lead, remainder copper.

2,102,388—Cyril Stanley Smith, assigned to American Brass Co., December 14, 1937.
Copper-base alloys which are easily machined and of good strengths containing up to 5 per cent silicon, 0.05 to 1.5 per cent sulfur.

2,113,283—Benoit J. Sirois, assigned to Phelps Dodge Copper Products, Corp., April 5, 1938.
Copper-silicon-iron or copper-silicon-zinc alloys, with specific reference to lead additions for increased machinability. Alloys of high tensile strength, ductility, good hot and cold working properties, resistance to corrosion and corrosion-fatigue failure, and freedom from season cracking. Range: 0.5 to 5.0 per cent silicon, 0.1 to 3.0 per cent iron, 0.05 to 2.0 per cent lead, remainder copper.

2,126,246—Louis S. Deitz, Jr., and Hanley H. Weiser, assigned to Nassau Smelting and Refining Co., August 9, 1938.
Cast articles of copper alloys. Cast articles having elongations before rupture under tensile stress of over 40 per cent are formed of alloys of copper together with 2.75 to 3.5 per cent silicon, and 0.75 to 1.45 per cent zinc.

2,157,149—Cyril S. Smith and Earl W. Palmer, assigned to American Brass Co., May 9, 1939.
Copper alloys suitable for various uses. Alloys workable both hot and cold contain copper together with 0.1 to 5.0 per cent silicon, 0.1 to 5.0 per cent manganese, and 0.005 to 0.25 per cent lithium or potassium.

2,175,223—Horace F. Siliman, assigned to American Brass Co., October 10, 1940.
Copper-boron-silicon alloys. Alloys which are of fine grain and resistant to corrosion contain copper together with 0.1 to 4.0 silicon, and 0.005 to 4.5 per cent boron.

2,185,956—Elmore S. Strang, Richard O. Farmer, and Edward H. Koenig, 1940.
Copper alloys suitable for paper pulp chests and other apparatus.

2,185,957—Elmore S. Strang and Richard O. Farmer, assigned to New Haven Copper Co., January 2, 1940.
Nickel-iron-silicon-copper alloys in different combinations, characterized by corrosion-resistant and hardness properties. Range: 0.5 per cent nickel, 1.0 per cent iron, 3.5 per cent silicon, 95.0 per cent copper.

2,185,958—Elmore S. Strang, Richard O. Farmer, and Edward H. Koenig, 1940.
Copper alloys suitable for paper pulp chests and other apparatus.

2,214,149—Alan U. Seybolt, assigned to Electro Metallurgical Co., September 10, 1941.
Copper-silicon-iron alloys. Alloys which have good resistance to corrosion are formed of copper together with 6.5 to 10.5 per cent silicon, and 5.15 per cent iron.

2,215,905—Theodore E. Kihlgren, assigned to International Nickel Co., Inc., September 24, 1940.
Methods of producing pressure-tight castings of cupro-nickel alloys containing silicon and manganese, within ranges: 25 to 35 per cent nickel, 0.0 to 1 per cent silicon, 0.4 to 1.25 per cent manganese, remainder copper. Further ranges and methods of casting also given.

2,231,940—Charles Victor Nylander, February 18, 1941.
Tin-aluminum-silicon-copper alloy having wear-resistant, corrosion, and fatigue-resistant properties. Contains 91.0 per cent copper, 4.1 per cent aluminum, 4.3 per cent tin, and 0.6 per cent silicon.

2,237,774—Maurice L. Wood, assigned to Chase Brass and Copper Co., April 8, 1941.
Heat treatment for improving the ductility of copper-base alloys containing silicon. A copper-base alloy containing about 1.5 to 3.5 per cent silicon is heated at about 1500 to 1700 F. for at least about 2 hr. at 1500 F., or 1.5 hr. at 1600 F., or 1 hr. at 1700 F.

British Patents

259,091—W. Denecke, February 2, 1926.
Copper-silicon alloys. Copper-silicon alloys contain about 5 to 10 per cent silicon and 1.5 to 12 per cent iron, nickel or cobalt, up to a total of 5 per cent chromium, tungsten, molybdenum, titanium and vanadium, and may also contain up to 1 per cent of arsenic and small quantities of tin, zinc, and lead.

278,355—Michael G. Corson, October 4, 1926.
Heat treating copper alloys. Copper-base alloys containing 3.7 to 6.7 per cent silicon are heated to 500 to 800 C. to form a solid solution of copper and silicon which will be supersaturated at room temperature and the metal is then quenched to preserve the condition of solid solution. The metal may be hot worked at 500 C. after the heat treatment and quenched from a temperature above 500 C. The alloy may contain small quantities of other metals such as 2 per cent or less tin, 5 per cent or less zinc, and 3 per cent or less aluminum.

288,974—Metallbank und Metallurgische Gesellschaft, A.G., April 16, 1927.
Copper-silicon alloys. Copper-silicon alloys which may also contain other elements such as nickel, iron, manganese, tin, chromium, tungsten, zinc, aluminum, magnesium, arsenic, antimony, calcium, cobalt, phosphorus and titanium, contain also up to 10 per cent lead, cadmium, and thallium.

303,684—Metallbank und Metallurgische Gesellschaft, A.G., February 29, 1928.
Copper alloys. Copper alloys are described containing nickel and iron and 1 to 4 per cent of silicon. The quantity of nickel is preferably 1 to 5 per cent and iron 4 to 6 per cent, and other metals may be added such as zinc up to 20 per cent, aluminum, manganese and tin up to 1 per cent each, and up to 0.5 per cent of an alkali or alkaline earth metal. The alloy may be annealed at 750 to 950 C. and is then quenched and drawn at 350 to 600 C.

350,750—Hirsch, Kupfer- und Messingwerke, A.G., July 1, 1930.
Copper-silicon-zinc alloys. Copper-silicon-zinc alloys contain 80 to 90 per cent copper, and 2 to 5 per cent silicon, and may also contain 1 to 3 per cent of one or more of the elements aluminum, manganese, cobalt, nickel, chromium, zirconium, tungsten, molybdenum, titanium, and tin.

352,639—Hirsch, Kupfer- und Messingwerke, A.G., February 13, 1930.
Castings of copper-silicon-zinc alloys. Castings are formed of copper-silicon-zinc alloys containing 65 to 80 per cent copper, and 2 to 6 per cent silicon, with or without 0.1 to 3 per cent of one or more of the metals aluminum, manganese, cobalt, iron, lead, nickel, chromium, zirconium, tungsten, molybdenum, and titanium. Mention is also made of an alloy containing 63 to 80 per cent copper, 37.2 per cent zinc, and 0.5 to 4 per cent silicon.

354,966—Hirsch, Kupfer- und Messingwerke, A.G., May 24, 1930.
Copper-silicon alloy for bells. Copper alloys for bells contain up to 6 per cent silicon, with or without tin about 1 per cent, or up to 20 per cent zinc, or both.

361,727—Berndorfer Metallwarenfabrick Arthur Krupp, A.G., February 3, 1931.
Copper alloys. Alloys for superheated steam fittings, valves, etc., consist mainly of copper, about 2 per cent iron, and 2 to 4.5 per cent silicon, all of the silicon and part of the iron being introduced by means of ferrosilicon.

362,877—Hirsch, Kupfer- und Messingwerke, A.G., June 4, 1930.
Copper-silicon alloys. Chill and die castings are made from copper-silicon alloys which may also contain zinc and not more than 2 per cent lead, antimony, bismuth, cadmium, tin, nickel, cobalt, manganese, iron, chromium, aluminum, titanium, tungsten, molybdenum, and/or zirconium. A suitable alloy is 65 to 94 per cent copper, 2 to 6 per cent silicon, and 3 to 28 per cent zinc.

424,709—American Brass Co., March 20, 1935.
Copper alloys containing silicon and manganese. See U. S. Patent 1,936,397. The alloy may be used for the manufacture of bolts, nails, screws, pipes, cartridge shells and ammunition cases, and tanks, boilers, etc.

530,447—American Brass Co., December 12, 1940.
Copper-base alloys. The copper-base alloy contains 0.1 to 5 per cent silicon, 0.0005 to 4.5 per cent boron, and the remainder substantially all copper. When the alloys are melted, some of the boron is oxidized to boric acid anhydride which has a fluxing effect. Boron is so active it reduces the oxides of many metals. Boron increases wear resistance. Also, the pickling operation is much easier.

Canadian Patents

335,211—Kenneth W. Ray and Howard W. Gould, assigned to American Brass Co., August 29, 1933.
Copper alloy. A copper-base alloy contains 0.5 to 3.5 per cent silicon and 1 to 19 per cent zinc.

345,219—Richard A. Wilkins, assigned to Revere Copper and Brass, Inc., October 9, 1934.
Copper alloy. A copper alloy containing silicon, tin, and zinc has increased tensile strength and elongation, and can be readily drawn and rolled. A typical alloy contains 90 per cent copper, 3.25 per cent silicon, 0.5 per cent tin, and 6.25 per cent zinc.

French Patents

650,419—Metallbank und Metallurgische Gesellschaft, March 5, 1928.
Alloys. Copper-silicon alloys suitable for the needs of the foundry contain 1 to 4 per cent silicon, 4 to 6 per cent iron, and 1 to 4 per cent nickel. Zinc, tin, manganese, and aluminum may also be present. Examples contain 2.5 per cent silicon, 5 per cent iron, 5 per cent nickel, 10 per cent zinc, and 0.5 per cent tin, with or without 0.1 per cent aluminum, and with or without 0.05 per cent of manganese.

668,332—Metallbank und Metallurgische Gesellschaft, March 5, 1928.
Alloys. The properties of copper-silicon alloys are improved by the addition of metals having a hardening effect such as nickel, cobalt, chromium, or iron. Examples contain (1) 96 per cent copper, 2 per cent nickel, 1 per cent silicon, 0.5 per cent cadmium, and 0.5 per cent manganese; and (2) 93.5 per cent copper, 2 per cent nickel, 1 per cent silicon, 1 per cent cadmium, and 3 per cent manganese.

691,823—N. V. Philips' Gloeilampenfabrieken, March 12, 1930.
Alloys. An elastic alloy contains copper, manganese, and about 4 per cent of silicon; for example, 95.5 per cent copper, 0.5 per cent manganese, and 4 per cent silicon.

698,776—Hirsch, Kupfer- und Messingwerke, A.G., July 9, 1930.
Copper alloys. Castings are made with copper alloys containing 65 to 80 per cent copper and 2 to 6 per cent silicon. The alloy may also contain aluminum, manganese, cobalt, iron, lead, nickel, chromium, zirconium, tungsten, molybdenum, or titanium, and tin. An alloy suitable for making bells contains 81 per cent copper, 4.5 per cent silicon, 0.5 per cent tin, and 14 per cent zinc.

698,777—Hirsch, Kupfer- und Messingwerke, A.G., July 9, 1930.
Describes similar alloys containing 80 to 90 per cent copper, and 2 to 5 per cent silicon; for example, 81 per cent copper, 4.5 per cent silicon, 14 per cent zinc, and 0.5 per cent tin.

698,778—Hirsch, Kupfer- und Messingwerke, A.G., July 9, 1930.
Describes antifriction alloys containing 65 to 80 per cent copper and 2 to 6 per cent silicon; for example, 70 per cent copper, 20 per cent zinc, 3 per cent silicon, and 1 per cent tin.

732,637—N. V. Careco Handelsmaatschappij, March 4, 1932.
Copper and silicon alloys. Up to 1 per cent of sulfur is added to alloys of copper and silicon while in the fluid state to prevent the formation of a film on the surface of the bath.

German Patents

490,305—Wilhelm Zimmer G.m.b.H., November 13, 1927.
Alloy. A copper-silicon-zinc alloy of outstanding mechanical and physical properties comprises 83-94 per cent copper, and approximately equal amounts of silicon and zinc.

492,460—Michael G. Corson, September 30, 1927.
Heat treating copper-silicon alloys. Copper-base alloys containing 3.7 to 6.7 per cent silicon are heated to 500 to 800 C. to form a solid solution of copper and silicon which will be supersaturated at room temperature and the metal is then quenched to preserve the condition of solid solution. The metal may be hot worked at 500 C. after the heat treatment and quenched from a temperature above 500 C. The alloy may contain small quantities of other metals such as 2 per cent or less tin, 5 per cent or less zinc, and 3 per cent or less aluminum.

501,413—Eugen Vaders, assigned to Metallges., A.G., March 6, 1927.
Alloys. Durable alloys suitable for casting comprise copper together with 3 per cent silicon, 4 per cent iron, 3 per cent nickel, 0.5 per cent tin, and 0.12 per cent manganese, with or without 0.15 per cent aluminum.

522,514—Eugen Vaders, assigned to Metallges., A.G., March 4, 1928.
Alloys for casting. Durable alloys suitable for casting comprise copper together with 3 per cent silicon, up to 6 per cent iron, up to 10 per cent nickel, up to 20 per cent zinc, 0.5 per cent tin, and 0.12 per cent manganese, with or without 0.15 per cent aluminum. The properties of the alloys may be improved by heating to 750 to 950 C., chilling and reheating to 350 to 600 C.

585,002—Eugen Vaders, assigned to Hirsch, Kupfer- und Messingwerke, A.G., September 27, 1933.
Copper alloys. Alloys suitable for making bearings or for casting in sand molds contain 80 to 90 per cent copper, 2.5 to 4.5 per cent silicon, and 5.5 to 17.5 per cent zinc, with or without 0.1 to 1 per cent aluminum, manganese, cobalt, nickel, chromium, zirconium, tungsten, molybdenum, titanium, and/or tin.

594,179—Richard Schulze, assigned to Allgemeine Elektricitäts Gesellschaft, March 13, 1934.
Alloys. Alloy containing 1 to 30 per cent tin and 0.71 to 3 per cent silicon, the remainder being copper, are used, without any special pretreatment, for making articles required to be shaped by hot-drawing.

New Publication Deals with Metallurgy of Copper

By the completion of their book "Metallurgy of Copper" Joseph Newton, Assistant Professor of Metallurgy, University of Idaho, and Curtis L. Wilson, Dean, Missouri School of Mines and Metallurgy (formerly Professor of Metallurgy, Montana School of Mines) have made available an important and timely publication for it is concerned with a major problem, the winning of copper from its ores and refining the metal to commercial grade. While the authors have not attempted to give a complete treatise of all practices used throughout the world, they have incorporated rather extensive discussions of selected modern procedures. By careful description of processes used, including flowsheets, details of equipment, electrical requirements, end results, etc., they convey an excellent picture of widely used methods.

The authors explain that with the 525-page book confined primarily to the subjects of extracting and refining, some other related subjects are not treated extensively, including the subjects of copper alloys and ore dressing, the latter being presented in summary form.

The authors have drawn heavily on various mining, smelting, and manufacturing companies for information, and numerous other publications and organizations, including A.S.T.M., a number of whose specifications are referred to in abstract form.

In addition to a detailed subject index there is an index of authors cited. Copies of the publication can be obtained from John Wiley & Sons, Inc., New York, at $6.00 each.

Modern Electroplating

Recently received from The Electrochemical Society, Inc., is a new book "Modern Electroplating" in which 26 authorities have contributed chapters. The basis for the book was the Symposium on Electroplating held during the 1941 meeting of the Society. The Electrodeposition Division, of which R. O. Hull is chairman, was directly responsible for the papers, with the executive and editorial committees consisting of the following, of whom many are active in A.S.T.M.:

Edwin M. Baker — A. Kenneth Graham
William Blum — Harold J. Read
Robert T. Gore — Gustaf Soderberg
Leon R. Westbrook

Following the opening chapter, a very extensive one on General Principles and Methods of Electroplating by Messrs. Blum, Beckman, and Meyer, there are in turn chapters by leaders in their field dealing with various types of plating: alloy, brass, cadmium, cobalt, gold, lead, nickel, etc. An appendix includes helpful tables and there is a detailed index. A valuable part of the book is the discussion following each chapter, and at the close of each chapter is a very condensed abstract in Spanish. Copies of the publication can be obtained from the Secretary and Editor of the Society, Colin G. Fink, 3000 Broadway, New York, N. Y., at $5.50 per copy.

Heat Flow Through Wet Walls

A joint research project to be carried out at Oregon State College under the joint sponsorship of its School of Engineering and the American Society of Heating and Ventilating Engineers has recently been announced to involve the study of heat flow through wet building walls. Various types of wall sections will be constructed and tested under conditions simulating heat loss during rainy weather.

ASTM Bulletin

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Inquiries

A.S.T.M. Headquarters, like the offices of other professional, technical and trade organizations, receives a great many inquiries each day. Every effort is made to answer these reasonably promptly—those coming from service branches of the Government always get top priority, and eventually we are able to handle most of the requests, even those on cards—for example, the post card request for a book that will tell all about the manufacture of steel and how it is used and how to buy it! The inquiries are of all kinds and from all kinds of people. Recently there has been an increased desire for information on so-called consumer goods standards, particularly from the teaching fraternity and especially high schools. Some inquiries must be handled "with kid gloves," so to speak, but for the most part the inquiries are based on a genuine desire, and frequently necessity, of obtaining helpful information. Sometimes we are not able to help very much—for example, the lawyer who wanted a standard on the number of times a window sash might be raised and lowered during the year and "what about these companies who say that with their design no trouble is experienced for years." Frequently the Society's *Proceedings* and other technical papers can be cited since they include a vast wealth of helpful information and data on many of the problems with which those inquiring are concerned. We are, of course, always pleased to make references to the A.S.T.M. publications, for only by widespread application of the information published will the ultimate benefits be derived from the intensive efforts on the part of leading American engineers and technologists which make the publications possible. Sometimes an inquiry is in a field where there is a definite lack of information and where some organization could justify sponsoring some fact finding. Frequently we suggest the service of consulting engineers or professional testing or research organizations.

In summary, each day we receive numerous examples of the intense desire of individuals and companies for authoritative information on a wide variety of engineering materials and problems. In many cases the Society can be of definite help.

Reports on Building Materials and Structures

Since their inception in 1938, the Reports on Building Materials and Structures as issued by the National Bureau of Standards have furnished Government agencies, the building industry, and other interested engineering and technical people, with valuable information from practically every available source on the engineering properties of building materials as incorporated in structural elements and equipment. The information has been particularly valuable in connection with low-cost housing, and the data have covered new materials, equipment, and the newer construction methods.

Reference is made in this Bulletin to Report BMS88 covering Recommended Building Code Requirements for New Dwelling Construction. In the earlier stages of this important work at the Bureau, the Bulletin, in an effort to publicize the work and to keep members informed with the various developments, carried lists of the reports. It was suggested that those concerned with the work should have their names placed on a special mailing list maintained by the Superintendent of Documents to receive notices of the new reports.

In the almost 100 documents issued, a variety of important problems have been covered. For example, there is a Plumbing Manual, a Report on Properties of Adhesives for Floor Coverings, and another for plastic calking materials. There are several dealing with surveys of roofing materials in various parts of the United States. Many reports cover investigations of constructional materials as sponsored by various organizations and companies. Each report carries a complete list of previously issued BMS items.

The development and publication of these reports represent a most important project in the field of materials, and the research work forming the basis of the reports, the compilation of the valuable data, and the careful editing, merit a note of commendation to the National Bureau of Standards.

Message from the President?

A note to President H. J. Ball at Lowell reminding him of the closing date for our December Bulletin brings the response that he will by-pass the President's Message for this issue. His note indicates that "beginning this week, I am taking on another evening class for two nights per week for sixteen weeks from 7 to 10 p.m. It's an Engineering Science and Management War Training Course in Textile Testing."

The editors think that this note embodies a splendid message indicating that from the top down A.S.T.M. people are doing all they can in the war effort.

Apparatus Exhibit in 1943

Discussion by the Executive Committee concerning the Exhibit of Testing Apparatus and Related Equipment which, under normal conditions, would have been sponsored by the Society at its annual meeting (1943 Annual Meeting in Pittsburgh, June 28–July 2) led to complete agreement that the exhibit be postponed. Of course, the primary reason for postponing the exhibit was the tremendous demand on the part of the materials industry for all kinds of research and testing instruments and laboratory supplies and having instruments and laboratory equipment on display in an exhibit would seem to be incongruous with this situation.

There was, of course, the possibility that a conference type of exhibit might be held whereby members of the Society and committee people who together constitute a unique group very definitely concerned with all kinds of apparatus and instruments could consult with instrument manufacturers and laboratory supply people. However, this would have necessitated the expenditure of time and effort on the part of representatives of companies in the instrument industry and it was felt the advantages of the proposal would not justify the efforts involved, since on urgent matters contacts can always be made by the instrument purchasers with the distributors and manufacturers.

It is confidently expected that when reasonably normal conditions return the Society will again arrange to sponsor these exhibits during its annual meeting every other year. Not only have they provided the leading laboratory supply and apparatus manufacturers an opportunity to contact an influential group and at the same time demonstrate important progress in the industry, but the exhibits have enabled A.S.T.M. committees, research laboratories, and various Government institutions to portray important research and investigative work under way in the field of materials. The scientific displays have always been a very important part of the exhibits.

Style of Reports

The Report of the Michigan Test Road referred to elsewhere in this issue is interesting not only from subject matter covered—various designs and methods of construction and aggregates—but also from the standpoint of the makeup and format of the report and its typography. Issued in letter size page with heavy board covers, bound in white plastic binding, printed in two colors, black and blue, with the numerous line drawings also in blue print form and splendidly illustrated throughout with clearly reproduced photographs, the report is a good example of one aiding readability and stimulating reading.

With so much published material for the technical man to attempt to cover, a report of this kind is much more likely to receive proper evaluation than many we have noted in ordinary typography, usually with a mixture of good and poor illustrations, lettering on line drawings frequently too small for easy identification, usually a lack of well selected internal headings, perhaps other typographical drawbacks. This Michigan report is a good answer to the question—why can't more technical publications be issued in more attractive and readable style and ormat? The answer is they can.

1943 Nominating Committee

In accordance with the latest provision in the By-laws providing that the Executive Committee shall select a nominating committee for officers at its October Quarterly meeting instead of at the January meeting as previously required, the Executive Committee on October 13 considered the report of the tellers, J. F. Vogdes, Jr., Director, Philadelphia Committee, Pennsylvania Economy League, Philadelphia, Pa., and F. B. Lysle, Bureau of Lighting and Gas, Philadelphia, Pa., on the recommendation of members for appointees on the nominating committee and selected the following committee and alternates.

Schedule of Meetings

Date	Committee	Place
January 18, 19	Executive Committee	Philadelphia, Pa.
January 18, 19	D-2 on Petroleum Products and Lubricants	Detroit, Mich.
January 20, 21	A-1 on Steel	Philadelphia, Pa.
January 11	Pittsburgh District	Pittsburgh, Pa.
January 20	Philadelphia District	Philadelphia, Pa.

Members	Alternates
Joseph Brobston	J. W. Kennedy
W. H. Finkeldey	J. J. Kanter
R. D. Bonney	H. E. Smith
Prévost Hubbard	C. N. Forrest
H. S. Mattimore	E. F. Kelley
F. E. Richart	H. J. Gilkey

The three immediate past-presidents—H. H. Morgan, W. H. Barr, and G. E. F. Lundell—serve as *ex-officio* members of the nominating committee. The nominating committee will meet in March and make nominations for each office—president, vice-president, and five members of the executive committee. The selections by the nominating committee will be announced to the members in the ASTM Bulletin prior to transmission of official ballots.

Modifications of Emergency Procedures

The procedure for issuing Emergency Alternate Provisions and Emergency Specifications has been publicized in the Bulletin and is published in the A.S.T.M. Yearbook. Numerous standing committees have used the procedures effectively to issue emergency alternate provisions ("pink slips") and emergency specifications, and although the mechanics to be followed have worked quite successfully there have been some points which needed clarification. Consequently the Executive Committee at its October meeting decided that all emergency provisions shall first be submitted to letter ballot of the subcommittee, and that the report from the committee in charge shall include reasons for any negative votes. For the information of those concerned with the emergency procedures, the latest corrected version is reprinted here:

"Such emergency alternate provisions shall first have the approval *by letter ballot* of the appropriate subcommittee of the sponsoring committee or duly appointed subgroup of that subcommittee and shall have the endorsement of the chairman of the main committee. The emergency provisions shall then be submitted to Committee E-10 *together with a covering report including reasons for any negative votes and other comments with respect to the proposal* [for approval for publication]. If approved *by Committee E-10, the emergency alternate provisions* [they] shall be published with the specification either in the form of a sticker or as an accompanying sheet and shall also be published in the next succeeding issue of the ASTM Bulletin. Any emergency provisions approved during the year shall be recorded in the next annual report of the standing committee. All such provisions are subject to annual review and the standing committee shall annually report its recommendations with respect to them."

The *italic* words have been added, and those in brackets omitted.

The procedure for complete emergency specifications is essentially the same as for emergency alternate provisions.

Officers and Members of Southern California District Committee, (from left to right): F. J. Converse, California Institute of Technology; R. B. Stringfield, Vultee Aircraft, Inc.; R. G. Osborne, Raymond G. Osborne Testing Laboratories; E. O. Slater, *Secretary*, Smith-Emery Co.; John Disario, *Chairman*, Columbia Steel Co.; E. F. Green, Axelson Manufacturing Co.; T. A. Fitch, Los Angeles Bureau of Standards, R. H. Pierson, Smith-Emery Co.

Below and on succeeding pages are shown the officers of A.S.T.M. District Committees. The order in each case being from left to right—Chairman, Secretary, Vice-Chairman.

Southern California District Has Forum on Materials

THE A.S.T.M. SOUTHERN California District Committee arranged a district meeting on Friday, November 13, in Los Angeles, which comprised a forum on materials following a dinner. There were over 100 A.S.T.M. members and guests present.

The speakers at the meeting and their subjects were as follows:

Activities and Parts the A.S.T.M. Plays in the Present Emergency—T. A. Fitch, Member of A.S.T.M. Executive Committee, Bureau of Standards, City of Los Angeles

Latest Developments and Specifications for Cement—H. E. Kaiser, California Portland Cement Co.

Present-Day Gasolines—W. E. Bradley, Union Oil Co.

Rubber—R. B. Stringfield, Vultee Aircraft, Inc.

N. E. Steels—J. A. Burgard, Columbia Steel Co.

Messrs. R. A. Bossert and G. A. Mowdry, Aluminum Co. of America, were present to show the movie "Unfinished Rainbows" and to answer questions on non-ferrous metals.

Mr. John Disario, Metallurgist, Columbia Steel Co., and chairman of the California District Committee presided at the meeting. There was interesting discussion with numerous people in the audience participating. The discussion on gasoline and rubber was particularly lively.

This is the second of these forums that has been sponsored by the active A.S.T.M. group centered around Los Angeles.

General arrangements for the meeting were carried out by Mr. Disario in cooperation with E. O. Slater, Secretary of the District Committee, who is President and Manager of Smith-Emery Co. The accompanying picture was taken at the meeting.

Cleveland District Officers
A. J. Tuscany, R. T. Bayless, Arthur W. Carpenter

N. L. Mochel to Speak at Philadelphia District Meeting January 20

DURING THE meetings of Committee A-1 on Steel to be held at the Hotel Warwick, Philadelphia, on Wednesday and Thursday, January 20 and 21, the A.S.T.M. Philadelphia District Committee will sponsor a meeting at which N. L. Mochel, Manager, Metallurgical Engineering, Westinghouse Electric and Manufacturing Co., will speak on a topic concerning the theory and use of specifications. All members of Committee A-1 on Steel and all Society members and friends in the Philadelphia area are cordially invited to attend. It is expected that during the meeting, there will be a showing of an outstanding sound color film. Tentatively the meeting is scheduled for January 20 at 8 o'clock, Mezzanine Floor, Hotel Warwick, 17th and Locusts Sts. Further details will be furnished those in the Philadelphia area and Steel Committee members.

Chicago District Committee Officers
E. R. Young, C. E. Ambelang, J. de N. Macomb

Detroit District Officers
C. H. Fellows, W. P. Putnam, Martin Castricum

New York District Committee Officers
M. P. Davis, G. O. Hiers, E. A. Snyder

Philadelphia District Officers
F. G. Tatnall, R. W. Orr, L. E. Ekholm

Philadelphia Meeting on Weld Stress Distribution

THE PHILADELPHIA District Committee of the Society joined with the Philadelphia Section of the American Welding Society in sponsoring a joint meeting on November 16 at the Engineers' Club at which Mr. Everett Chapman, President, Lukenweld Co., Coatesville, Pa., gave one of his usually interesting discussions, this time on the subject "Stress Distribution." Prior to some excellent motion pictures he showed slides demonstrating effect of notches, variations in sections, the very questionable value of increased section thickness by allowing weld metal to increase somewhat, etc. The motion pictures were based on studies of Bakelite specimens which were heated at various points with the stresses confined at various locations and in different ways. These pictures showed the importance of very careful handling of so-called "stress relieving methods." Preceding the talk Reel Number Four of the General Electric Instruction Film was shown.

A.S.T.M. arrangements for this meeting were handled by A. O. Schaefer, The Midvale Co., in cooperation with F. G. Tatnall, The Baldwin Locomotive Works, chairman of the A.S.T.M. Philadelphia District. There was an excellent attendance at the meeting with many A.S.T.M. members present.

St. Louis Members Have Luncheon

A NUMBER of members of the Society in the St. Louis area recently attended a luncheon meeting at which there was a discussion of various phases of A.S.T.M. work including the possibility of holding a meeting within the next few months in the St. Louis area. The Assistant to the Secretary was present and outlined some of the current work and problems in A.S.T.M. In addition to Dr. Hermann von Schrenk, Consulting Timber Engineer, Chairman of the A.S.T.M. St. Louis District Committee, and L. A. Wagner, General Superintendent, Missouri Portland Cement Co., Secretary of the group, who made plans for the luncheon and E. J. Russell, of Mauran, Russell, Crowell & Mullgardt, Vice-Chairman, some fourteen other members were present.

Northern California District Officers
Dozier Finley, T. P. Dresser, Jr., M. C. Poulsen

Pittsburgh District Officers
A. R. Ellis, H. A. Ambrose, J. J. Shuman

Pittsburgh Meeting, January 11, on Conservation, Glazing Materials

THE PITTSBURGH District Committee is sponsoring a local meeting to be held in the Auditorium of the Mellon Institute of Industrial Research on Monday, January 11, at which Secretary-Treasurer C. L. Warwick, who is also Chief, Specifications Branch, WPB Conservation Division, will speak and Dr. F. W. Adams, Senior Industrial Fellow, Mellon Institute of Industrial Research, will present an address.

St. Louis District Officers
Hermann von Schrenk, L. A. Wagner, E. J. Russell

Under the leadership of A. R. Ellis, President, Pittsburgh Testing Laboratory, chairman of the A.S.T.M. Pittsburgh District Committee, the group has been planning this meeting for some time and extends a cordial invitation to all members of the Society and guests to attend.

Dr. Adams will speak on the subject "Behavior of Glazing Materials Subjected to Explosion" and his address will be illustrated with motion pictures. Mr. Warwick's talk will be on a subject with which he has been very closely concerned for many months, namely, "The Role of Specifications in Conservation of Critical Materials."

A.S.T.M. members and committee members in the Pittsburgh area will receive additional notices of the meeting and invitations will be extended to other groups in the Pittsburgh area to be present. H. A. Ambrose of the Gulf Research and Development Co., Secretary of the Pittsburgh District Committee, and other members are assisting Mr. Ellis with the meeting.

Offers of Meeting Papers by February 1

COMMITTEE E-6 ON Papers and Publications is extending to each member of the Society the customary invitation to offer papers for presentation at the 1943 annual meeting in Pittsburgh on subjects relating to the properties and testing of engineering materials.

In order that as many as possible of the technical papers and committee reports can be preprinted in advance of the meeting, it is desirable that the program be developed early. Committee E-6 has fixed February 1 as the limiting date for receipt of offers but members who may be considering the submission of a paper are urged to send their offers to A.S.T.M. Headquarters *as soon as possible*. Suitable blanks which should be used in sending the necessary information with respect to the offer of a paper can be obtained from the Society offices. Each offer must be accompanied by a summary of the proposed paper in such detail that its scope is clear and also to point out features that in the author's opinion make the paper a desirable one for presentation and discussion.

Analytical Balances and Weights

A MOST INTERESTING and informative discussion in connection with analytical balances and weights appears as supplementary information to the Methods of Chemical Analysis of Portland Cement (C 114 – 42 T) as published in the 1942 compilation of "A.S.T.M. Standards on Cement." It is sponsored by the Working Committee on Methods of Chemical Analysis of Committee C-1 on Cement under the chairmanship of W. C. Hanna, Chief Chemist, California Portland Cement Co., and discusses the testing of balances for compliance with the requirements of the Standard Method C 114. It mentions and discusses the various points requiring consideration in precision determination of weights including such items as inequality of balance arms, reproducibility of results, and the various methods that are employed for weighing including (1) direct weighing, (2) weighing by substitution, and (3) weighing by transposition. The various classes of standard laboratory weights are considered. The specifications are given for Class S weights.

Southern California District Committee Officers
John Disario, E. O. Slater, W. C. Hanna

While intended primarily for use in connection with the methods of analysis of cement, the discussion is of very general interest and applies to the use of accurate analytical balances in the laboratory for other products as well as cement.

The appearance of this compilation of A.S.T.M. Standards on Cement is referred to in the article on publications appearing on another page of this BULLETIN

A.S.T.M. Standards in AISE Crane Specifications

THE SPECIFICATIONS for Electric Overhead Traveling Cranes for Steel Mill Service recently approved by the Association of Iron and Steel Engineers incorporate a number of references to A.S.T.M. standard specifications. These requirements for cranes were developed by the AISE Standardization Committee of which F. W. Cramer, Carnegie-Illinois Steel Corp., is chairman. F. D. Egan, Electrical Superintendent, Bethlehem Steel Co., is general chairman of the AISE Standardization Committee. Connected with the group are a number of representatives of manufacturers of cranes. In order to develop sound data on crane girder design, research work was carried out at Lehigh University and the new specifications incorporate considerable data from this work. A.S.T.M. specifications are referred to, with physical properties and design data based on these, including Spec. for Steel for Bridges and Building (A 7); Spec. for Structural Rivet Steel (A 141); Spec. for High-Strength Structural Rivet Steel (A 195). Reference is also made to Spec. for Low-Alloy Structural Steel (A 242).

Requirements in the specifications cover structural design and mechanical details including track wheels, rails, bumpers, etc. In the section on electrical details the wiring is indicated to be in accordance with A.S.T.M. Spec. B 8 – 36, Class C. An appendix includes helpful information, some of it developed at Lehigh University, with considerable tabular data. Copies of these AISE specifications can be obtained from the association's offices at 1010 Empire Building, Pittsburgh, Pa., at $1.00. per copy.

For a complete list of Emergency Specifications and Emergency Alternate Provisions ("pink slips"), see pages 55 and 56.

Dudley Medal Committee Appointed

THE COMMITTEE on Award of the Charles B. Dudley Medal has been appointed by the Executive Committee and consists of the following members:

Sabin Crocker, *Chairman*, Senior Engineer, Engineering Division, The Detroit Edison Co.

C. S. Reeve, Technical Adviser, The Barrett Division, Allied Chemical and Dye Corp.

J. R. Townsend, Materials Standards Engineer, Bell Telephone Laboratories, Inc.

This committee will review the eligible technical papers presented at the 1942 annual meeting in Atlantic City and select the one of outstanding merit which constitutes an original contribution on research in engineering materials. The award will be made at the Forty-sixth Annual Meeting in Pittsburgh, June 28 to July 2, 1943. This Medal was established in 1925 by voluntary subscriptions from members of the Society as a means of stimulating research, recognizing meritorious contributions to the Society's publications, and in commemoration of the first President of the Society whose leadership has profoundly influenced A.S.T.M. development.

1943 Marburg Lecture Committee

THE COMMITTEE which will select the Edgar Marburg Lecturer for 1943 has been appointed. Under the rules governing the lecture, this group consists of a member of the Executive Committee, a member of Committee E-9 on Research, and a member of Committee E-6 on Papers and Publications. The personnel, representing the respective committees in the order named, is as follows: Past-President G. E. F. Lundell, Chief, Chemistry Division, National Bureau of Standards, Washington, D. C.; C. H. Scholer, Professor of Applied Mechanics, Kansas State College of Agriculture and Applied Science, Manhattan, Kans.; and J. R. Freeman, Jr., Technical Manager, The American Brass Co., Waterbury, Conn. Doctor Lundell is serving as chairman.

***The American Society for Testing Materials*—** **a national technical Society of some 4700 members—individuals, companies, organizations, colleges—with an additional 1200 members of technical committees, has since 1898 concentrated its activities in the field of engineering materials, developing widely used standard specifications and methods of testing materials, sponsoring research, and publishing thousands of pages of information and data on the properties and testing of materials.**

The American Society for Testing Materials is outstanding in the number of its members who actively participate. Among the distinct assets of membership are the friendships begun or renewed in this work, the obtaining of experience by informal and committee contacts and through participation in meetings gaining new perspective and inspiration.

A CORDIAL INVITATION is extended to all who are concerned with engineering materials to become members of the Society.

Textile Fiber Atlas

RECENTLY ISSUED by the American Wool Handbook Co., 303 Fifth Ave., New York, N. Y., is a collection of over 300 photomicrographs of various natural and synthetic textile fibers, as arranged and prepared by Dr. Werner Von Bergen, Director of Laboratories, Forstmann Woolen Co., and a very active A.S.T.M. member, and Walter Krauss, Microscopist, Sears, Roebuck Textile Laboratory. The discussion and text with considerable tabular material are arranged according to natural animal fibers, natural vegetable fibers, artificial and synthetic fibers, and mineral fibers. The photomicrographs are reproduced in excellent clarity, and the publication should be of much value to all who are interested in the subject. The book (9- by 12-in. page size) is bound in heavy paper cover with a plastic binding and costs $3 per copy, postage being extra. Discounts are given to schools and colleges and quantity discounts also apply.

Orleans Bridge over Klamath River, California, adjudged by the American Institute of Steel Construction the most beautiful 1940 small bridge. A.S.T.M. standards covered the cement and structural steel. Steel suspension span, 360 feet long; reinforced concrete girder spans of 135 and 170 feet.

Courtesy *Steel*

Numerous Publications Issued; Book of Standards on Press

While the 1942 Book of Standards is the publication on which most effort is being expended by both Headquarters and the printer, and three or more forms a day are being released for press, several other books have come off press, including a number of compilations of standards which it was possible to print before the Book of Standards forms were released.

Among the 1942 publications which have become available are the following:

- Steel Piping Materials
- Electrical Heating and Resistance Alloys
- Petroleum Products and Lubricants
- Coal and Coke
- Textile Materials
- Cement
- 1942 Year Book

A few notes about each of these publications are given here.

Steel Piping Materials.—This compilation, covering pipe, tubing, forgings, castings, bolting, is a greatly extended one based on the compilation of previous years, which, however, covered materials primarily for high-temperature and high-pressure service. This is the first time that *all* of the steel specifications for pipe, tubes, and such materials have been issued in one compact volume. These specifications are widely used and a number of emergency alternate provisions have been issued, these pink slips being included with the book. 250 pages, heavy paper cover; to members, $1.25; list price, $1.75.

Electrical-Heating and Resistance Alloys.—In addition to the report of Committee B-4, there are given the 20 specifications and tests covering: electrical-heating materials, electrical-resistance materials, thermostat metals, materials for lamps and radio tubes, and structural and electrical-resistor materials for furnaces, etc. As information there are published Proposed Specifications for Chromium-Nickel-Iron Alloy Castings for High-Temperature Service; Proposed Method of Test for Effect of Controlled Atmospheres Upon Alloys in Electric Furnaces; and a short discussion on Standardization of Contact Rivets. This compilation also includes a paper covering "An Electrical Contact Testing Machine" (appearing in this Bulletin), and another paper dealing with "Electrical Surge Tests on Contact Materials." Also included will be the paper on "Methods of Testing Thermocouples and Thermocouple Materials" by W. F. Roeser and H. T. Wensel, printed by the National Bureau of Standards. 140 pages, heavy paper cover; to members, $1.15; list price, $1.50.

Petroleum Products and Lubricants.—This compilation issued each year since 1927 includes in their latest approved form all of the 73 test methods, 14 specifications, and two lists of definitions of terms relating to petroleum, a great majority of these standards being in the charge of Committee D-2. The compilation is of value also in that it includes four proposed test methods approved for publication as information and for comments covering: oil content of paraffin wax; color of lubricating oil by means of photoelectric colorimeter; potential gum in aviation gasoline; and oxidation characteristics of heavy-duty crankcase oils.

The annual report of the committee is also included, thus detailing important changes in these standards put into effect during the past year. 452 pages, heavy paper cover; to members, $1.50; list price, $2.25.

Coal and Coke.—This compilation includes the 27 standard and tentative specifications and methods of test for coal and coke, covering sampling, chemical analysis, definitions, classifications, size, dustiness, grindability, etc., in the charge of Committee D-5 on Coal and Coke. 125 pages, heavy paper cover; to members, $1.00; list price, $1.35.

Textile Materials.—A 422-page publication which gives the 73 widely used specifications, tolerances, methods of testing, and definitions of terms developed by the Society's largest committee, D-13. It is a valuable publication for the textile industry, not only because of the standards, but the other related information which includes photomicrographs and basic properties of textile fibers, yarn number conversion table, practice for designation of yarn construction, psychrometric table for relative humidity, glossary of terms, practice for calculating number of tests to be specified in determining average quality of a textile material, test for accelerated aging of textiles, quantitative analysis of textiles, estimating clean wool content in wool in the grease, American war standard specification and description of color, and test for diffuse transmission of blackout materials for incandescent lamp light. Abstracts of the following three technical papers presented at the meeting of Committee D-13, October, 1941, are included: Engineering Use of Statistical Techniques in Testing, Application of the Statistical Method for Determining Number of Tests for Strength and Elongation of Rayon Yarns, and An Example of the Use of Statistics in a Study of Chemical Test Methods. Two other papers presented at this meeting on Development of Methods for the Evaluation of Textile Finishes and Application of Rank Correlation to the Development of Testing Methods have been published in the January, 1942, and December, 1942, ASTM Bulletins, respectively. 440 pages, heavy paper cover; to members, $1.50; list price, $2.25.

Cement.—This compilation gives in their latest form all specifications and tests for cement (portland, low-heat hydration, high-sulfate resistance, high-early-strength, treated portland, natural, masonry). Also the Manual of Cement Testing which provides helpful information on this subject. The emergency alternate cement specification EA – C 150 also is given and there is a selected list of better known and more important sources of information on portland cement. 120 pages, heavy paper cover; to members, $1.00; list price, $1.35.

Year Book.—The 1942 Year Book with a complete list of the Society's members and full personnel of all technical committees, including joint and sectional committees for which the Society is responsible, has been distributed to members who requested copies. Including various regulations, by-laws, etc., the 1942 book comprises some 350

pages. This book is distributed to the members for use in connection with the activities of the Society.

Book of Standards

Anyone who has had experience with book work, either as author or editor, can realize the tremendous amount of work involved in issuing the 1942 Book of Standards, which in three parts will total about 5000 pages. Several forms (32 pp. each) of the Book are released for printing daily, and rapid progress is being made on completion of the volumes with the expectation that Parts II and III will be available in December; Part I, probably not until early January.

Each member of the Society will, of course, receive the part or parts of the Book which he has requested and instructions for which he has transmitted, and the purchasers of the 1939 Book have been given full information about the publication.

This year a slight increase has been made in the price of the books to members for purchase of *extra* copies from the previous figure of $5.50 to the new price of $6.00 per part; $12.00 for two parts; or $18.00 for all three parts. The new list prices (nonmembers) are $9.00 per part; $18.00 for two parts; and $27.00 for all three parts. Slight increases will also be effective for copies of two parts or three parts of the 1943 and 1944 Supplements.

Material Substitutions and Supply, Issue No. 6

November 2, 1942

PURPOSE . . . THE MATERIAL SUBSTITUTIONS AND SUPPLY list is compiled by the WPB Conservation Division, Conservation and Substitution Branch to reflect the *relative essentiality* and the *current relative supply status* of materials useful to the war effort. The list is intended also to promote *conservation* of critical materials through *substitution* of less critical materials.

GROUPING . . . The materials are divided into three groups. *Group I*—critical materials highly essential to the war effort. The supplies of these materials are insufficient for existing war demands. . . . *Group II*—materials essential to the war effort. The supplies of these materials are at present in balance with immediate demands. . . . *Group III*—materials available in significant quantities, and which are particularly recommended as substitutes for critical materials. American resourcefulness in bringing these Group III materials into use as substitutes for critical materials will continue to play an important role in winning the war.

The grouping of the materials is not based primarily on the extent of *applicable governmental regulations*, although a close relationship usually exists. In isolated instances, where restrictions on nonessential uses of a material make it freely available for limited applications, an *artificial status* for such a material for certain uses necessarily results.

It is important to point out also that sudden demands and changes in regulations may rapidly affect the availability of any given material.

Additional factors which determine the placement of the materials in the groups are *transportation facilities*, *production facilities*, *stocks* of *raw materials* and of *finished products*, and in some instances *labor*.

METALS "LADDERS" . . . The Sixth Issue of MATERIAL SUBSTITUTIONS AND SUPPLY presents several important changes, the first of which is the listing of the *Metals* in Groups I and II in ladders of relative availability. For example, List *a* of Group I lists the Non-Ferrous Metals of related function in ladder sequence. This means that, with respect to the balance of the metals in List *a*, the metal at the top of the list is both highly essential for war applications and most critical in its supply status. The metal second in position is also highly essential, and only slightly less critical. The balance of the metals in this list then follow in the order of their relative essentiality and their current supply criticality.

List *b* is a ladder of Miscellaneous Critical Metals. List *c*, a ladder of Ferro-Alloy Metals. List *d*, of Basic Steels and Irons. List *e*, of Steel Products. There are nine ladders in the two groups. The relative arrangement is significant only in a vertical direction. Lists *c'*, *d'*, and *e'* are applicable, respectively and successively, to Lists *c*, *d*, and *e*.

It should be emphasized that substitution of, for example, "rung" three of a ladder in place of "rung" two represents a fractional gain which will probably be of only short-lived benefit, whereas substitution of a "rung" a long step downward on the ladder represents a real contribution to the solution of our material shortages problem.

Group I

The available supply of the following materials is inadequate for war and essential civilian uses and, in many cases, for war purposes alone. . . . The secondary and scrap metals are each classified with their corresponding primary metal; in any given case the highest grades are the most critical and the secondary grades less critical. The order of listing has significance only in the case of metals.

A. METALS

List a	*List b*	*List c*
*Magnesium	*Tantalum	*Molybdenum
*Aluminum	Beryllium	*Nickel
*Copper	Rhodium	*Vanadium
*Tin	Lithium	*Tungsten
*Bronze	Iridium	Cobalt
*Brass		Chromium
Cadmium		Calcium Silicon
Zinc		

List d	*List e*
	Steel Products
*Chrome-Nickel Stainless Steel	*Bars
*Tool Steel	*Forgings
*Straight Chrome Stainless Steel	*Seamless Tubing
SAE Alloy Steel	Plates
NE Alloy Steel	Wire Rope
Low Phosphorous Pig Iron	Wire Products
Alloy Cast Iron	Castings
Wrought Iron	Structural
	Piling
	Tinplate

B. PLASTICS

Copolymers of Vinyl Acetate and Vinyl Chloride
Ethyl Cellulose
Methyl Methacrylate: Molding Compound Sheet
Phenolic Laminates
Phenolic Laminated Rods, Tubes
Phenolic Molding Compound, Resins
Polystyrene
Polyvinyl Acetate
Polyvinyl Alcohol
Polyvinyl Butyral
Polyvinyl Chloride
Polyvinyl Formal
Vulcanized Fiber: Heavy and some Medium Sheets

C. CHEMICALS

Acrylic Acid and Acrylates
*Acrylonitrile
Alcohol: Amyl, Capryl, Butyl, Lauryl
Aluminum Trihydrate
Aluminum Chloride: Anhydrous
Ammonia, Aniline, Anthraquinone and Their Derivatives
Aromatic Petroleum Solvents
Arsenic and Derivatives
Benzol and Derivatives
Bleaching Powder
*Butadiene
Butyl Acetate
Calcium Cyanamide and Derivatives
Calcium Hypochlorite
Chlorosulfonic Acid
Cobalt Chemicals
Copper Chemicals
*Cresols
Cyanamide
Diphenylamine
Glycerol
Iron Oxide: Synthetic Yellow Hydrated
*Lithium Chemicals
Mannitol
Naphthalene and Derivatives
Naphthenic Acids and Derivatives
Nitric Acid
Pentaerythritol
Perchlorethylene
Perchloric Acid
*Phenol and Derivatives
Phosphate: Tricresyl, Triphenyl
Phthalic Anhydride and Derivatives
Silica Gel
Sodium Nitrate
Sorbitol
Strontium Chemicals
*Sulfamic Acid
Sulfur Chlorides
*Toluol and Derivatives
Trichlorethylene
Urea
Xylol
Zinc Oxide: French Process

D. LUMBER (OF SPECIFIED GRADES)

Baldcypress (F.A.S. Selects—No. 1)
Balsa (all Grades)
Beech (F.A.S.—Selects—No. 1)
Douglas Fir (Stress Grades—No. 1—No. 2)
Eastern Spruce (Nos. 1, 2, 3)
Eastern White Pine (No. 2—No. 3)
Hard Maple (F.A.S. Selects—No. 1)
Hickory (F.A.S.—Selects—No. 1)
Idaho White Pine (No. 2—No. 3)
*Mahogany (all Grades)
Noble Fir (No. 1—No. 2)
Northern White Pine (No. 2, 3)
Norway Pine (No. 2—No. 3)
Ponderosa Pine (No. 2—No. 3)
Rattan
Rock Elm (F.A.S. Selects—No. 1)
Sitka Spruce (Selects No. 1—No. 2)
Southern Pine (Stress Grades—No. 1—No. 2)
Sugar Pine (No. 2—No. 3)
*Teak (all Grades)
Walnut (F.A.S.—Selects—No. 1)
West Coast Hemlock (Nos. 1, 2)
Western Larch (Stress Grades)
White Ash (F.A.S. Selects No. 1)
White Fir (No. 2—No. 3)
White Oak (F.A.S. Selects—No. 1)
Yellow Birch (F.A.S. Selects No. 1)
Yellow Poplar (F.A.S.—Saps-Selects—No. 1)

E. TEXTILE AND FIBERS

Agave:
Cantala
Fourcroydes
*Henequen, etc.
*Sisalana
Alpaca
Bristles: Pig and Hog: 2" and over
Cotton: Duck, Long Staple, Seed: SXP
Down
Feathers: Goose and Duck: Up to 4"
Hemp: Fiber, Seed
Jute: Burlap, Fiber
Kapok
*Manila
Nylon
Rayon: High Tenacity
Shearlings
Silk: *Garnetted, *Noils and Waste, *Raw, Used and Reclaimed

F. MISCELLANEOUS PRODUCTS

Acrylic Resins
*Agar
*Alumina: Calcined
Aluminum Oxide Abrasives
Aluminum Pigments
Asbestos: Long Fiber
Babassu Kernels
*Bauxite: Restricted
Carbon Black: Furnace
*Castor Beans
Coke: Petroleum
Copra
Corundum
Cotton: Chemical Pulp *Linters
Cryolite
Diamond Dies: Fine Sizes
Gasoline: Aviation
Graphite
Mica: *Block, Splittings
Oils: Babassu, Cashew Nut Shell, *Castor, Coconut, *Oiticica, Palm Kernel, Rapeseed, Sperm, *Tung
Phenol-Formaldehyde Resins
Plywood: Restricted Binder
Polystyrene Resins
Pyrethrum
Quartz Crystals
*Quinine
Refractories: Kyanite: India Chromite
Rotenone
Rubber: *Chlorinated, *Crude, *Latex, Scrap and Reclaimed, *Synthetic
*Shellacs
Spodumene
Talc: Steatite
Vinyl Resins

* Most critical.

Group II

Materials that are essential to the war industries but the supplies of which are not as limited as those in Group I. . . . When considering the use of an item in Group II as a substitute for an item in Group I their relative available quantity should be kept in mind, since substitution of a small tonnage material, as for example silver for copper, would if continued indefinitely soon exhaust the supply of the smaller tonnage material. The order of listing has significance only in the case of metals.

A. METALS

List b'	*List c'*	*List d'*	*List e'* *Steel Products*
Platinum	Calcium	Cast Iron:	Galvanized Sheet
Ruthenium	Columbium	Malleable	Black and Terne Plate
Bismuth	Ferrotitanium	Gray Cast	Sheet and Strip
Mercury	Zirconium, Alloys	Pig Iron: except Low Phos.	Pipe
Antimony	Silicon and Alloys		Rails
Silver	Silicomanganese		Reinforcing Bars
	Ferrosilicon		
	Spiegeleisen		

B. PLASTICS

Cellulose Acetate
Cellulose Acetate Butyrate
Cellulose Nitrate
Melamine Resins
Urea-Formaldehyde Resins
Vinylidene Chloride
Vulcanized Fiber: Thin and some Medium Sheets

C. CHEMICALS

Acetic Acid
Acetic Anhydride
Acetone
Alcohol: Ethyl, Isopropyl, Methyl
Atebrine: for Quinine
Bromine
Chlorates and Perchlorates
Chlorinated Hydrocarbon Solvents: except those in Group I
Chlorinated Waxes
Chlorine
Chromium Chemicals
Citric Acid
Dichloroethyl Ether
Ethers
Formaldehyde and Paraformaldehyde
Glycols
Hydrogen Chloride: Anhydrous
Hexamethylene Tetramine
Iodine
Ketones
Lactic Acid, Lactates
Maleic Acid and Anhydride
Manganese Chloride: Anhydrous
Mercury Chemicals
Molybdenum Chemicals
Nickel Chemicals
Nitrocellulose
Phosphorous
Phosphorous Oxychloride
Phosphorous Pentoxide
Potassium Permanganate
Silver Chemicals
Sodium Sulfide
Tannic Acid

D. LUMBER (OF SPECIFIED GRADES)

Baldcypress (No. 2)
Beech (No. 2)
Douglas Fir (Selects)
Eastern Hemlock (No. 1—No. 2)
Eastern White Pine (Selects—No. 1)
Hard Maple (No. 2)
Idaho White Pine (Selects Nos. 1, 4)
Magnolia (F.A.S.—Selects—No. 1)
Noble Fir (Selects—Shop)
Northern White Pine (Selects—No. 1—Shop)
Pecan (F.A.S.—Selects—No. 1)
Ponderosa Pine (Selects Nos. 1, 4)
Redgum (F.A.S.—Selects—No. 1)
Red Oak (F.A.S.—Selects—No. 1)
Redwood (Selects—No. 1)
Sap Gum (F.A.S.—Selects—No. 1)
Sitka Spruce (Shop)
Soft Elm (F.A.S.—Selects—No. 1)
Soft Maple (F.A.S. Selects—No. 1)
Southern Pine (Selects)
Sugar Pine (Selects—No. 1—No. 4)
Sycamore (F.A.S.—Selects—No. 1)
Tupelo Gum (F.A.S. Selects—No. 1)
Walnut (No. 2—No. 3)
West Coast Hemlock (Selects)
Western Redcedar (Selects—No. 1)
White Ash (No. 2—No. 3)
White Oak (No. 2—No. 3)
Yellow Poplar (No. 2—No. 3)

E. TEXTILES AND FIBERS

Flax: except Seed Tow
Hair: Horse Tail and Mane
Ixtle
Rayon: Filament Staple Fiber
Sunn
Wool: New

F. MISCELLANEOUS PRODUCTS

Albumin: Blood
Alkyd Resins
Alpha Cellulose Wood Pulp
Cadmium Pigments
Caffeine
Cellophane
Cellulose Acetate
Chrome Pigments
Cohune Nuts and Kernels
Diamonds: Industrial
Ester Gums
Fluorspar
Halogenated Hydrocarbon Refrigerants
Hides
Leather
Mercury Pigments
Molasses
Natural Gas
Natural Resins: except Rosin
Oils: Fish, Fish Liver, Palm, Pine
Petroleum Products: Lubricating Oil: Penn Grade
Plywood: Unrestricted Binder
Refractories: High Alumina, Insulating Brick, Kyanite: Domestic, Silicon Carbide, Sillimanite
Rutile
Silicon Carbide Abrasives
Tanning Materials
Tetraethyl Lead
Theobromine
Urea - Formaldehyde Resins
Vermiculite
Vulcanized Fiber: Thin and some Medium Sheets

Group III

Materials that are available in significant quantities as substitutes for scarcer materials—unless supply is locally restricted by labor, manufacturing or transportation difficulties.

A. METALS

- Ferroboron
- Ferromanganese
- Gold
- Indium
- Lead
- Osmium
- Palladium
- Sodium

B. PLASTICS

- Casein
- Lignin

C. CHEMICALS

- Ammonia Alum
- Aluminum Sulfate:
  - Commercial
- Barium Carbonate
- Borax
- Boric Acid
- Camphor
- Caustic Soda
- Chromic Acid for Plating
- Lead Chemicals
- Muriatic Acid
- Nicotine Sulfate
- Sodium Aluminate
- Sodium Silicates
- Sodium Silicofluoride
- Zinc Chemicals:
  - except Zinc Oxide: French Process

D. LUMBER (OF SPECIFIED GRADES)

- Baldcypress (No. 3)
- Beech (No. 3)
- Douglas Fir (Shop—No. 3)
- Eastern Hemlock (No. 3)
- Eastern White Pine (No. 4—No. 5)
- Hard Maple (No. 3)
- Hickory (No. 2—No. 3)
- Idaho White Pine (No. 5)
- Magnolia (No. 2—No. 3)
- Noble Fir (No. 3)
- Northern White Pine (Nos. 4, 5)
- Pecan (No. 2—No. 3)
- Ponderosa Pine (No. 5)
- Redgum (No. 2—No. 3)
- Red Oak (No. 2—No. 3)
- Redwood (No. 2—No. 3)
- Sap Gum (No. 2—No. 3)
- Sitka Spruce (No. 3)
- Soft Elm (No. 2—No. 3)
- Soft Maple (No. 2—No. 3)
- Southern Pine (Shop—No. 3)
- Sugar Pine (No. 5)
- Sycamore (No. 2—No. 3)
- Tupelo Gum (No. 2—No. 3)
- West Coast Hemlock (Shop—No. 3)
- Western Larch (No. 3)
- Western Redcedar (No. 3)
- White Fir (No. 4)
- Yellow Birch (No. 2—No. 3)

E. TEXTILES AND FIBERS

- Cotton: Short Staple
- Flax: Seed Tow
- Hair: Calf, Cattle, Goat
- Wool: Reprocessed, Reused

F. MISCELLANEOUS PRODUCTS

- Asbestos: Short Fiber
- Asphalt
- Bauxite: Unrestricted
- Bentonite
- Brick
- Carbon Black:
  - except Furnace
- Casein
- Cement: Portland
- Ceramics
- Charcoal
- Clay: Common
- Coal
- Coal Tar:
  - Hi-Flash Naphtha, solvent
  - Pitch
- Coke: Coal
- Concrete:
  - Nonreinforced
- Cork
- Corn Stalks
- Diatomite
- Emery
- Feldspar
- Fiberboard
- Flint
- Garnet
- Gilsonite
- Glass
- Glues: Animal, Vegetable
- Gypsum and Products
- Ilmenite
- Lead Pigments
- Lignin:
  - Extender for Plastics
  - Linoleum Paste
- Lime
- Lithopone
- Mica: except Block and Splittings
- Mineral Wool
- Oils: Corn, Cottonseed, Linseed, Neat's-foot, Peanut, Soybean, Sunflower, Tall
- Paper and Products
- Paperboard and Products:
  - Waste Paper Base pref.
- Petroleum Products:
  - Aliphatic Naphthas
  - Crude Oil, Gasoline: except Aviation,
  - Lubricating Oil: except Penn Grade
- Pottery
- Red Lead
- Refractories: Fire Clay, Magnesite, Olivine, Silica
- Rosin and Derivatives: except Ester Gums
- Salt
- Silica Sand
- Soybean Protein
- Starch: Domestic
- Stones: Granite, Limestone, Marble, Slate, Soapstone
- Straw
- Sulfur
- Tile
- Titanium Pigments
- Tripoli
- Turpentine
- Vitamin "A" Oils
- Wallboard
- Wood Products: Sawdust, Wood Fiber, Wood Flour, Wood Pulp: except Alpha Cellulose
- Zinc Oxide:
  - American Process

Supplementary List

Materials (not all in Group III) on which the Inventory Restrictions of Priorities Regulation No. 1 have been released

- Andalusite: Domestic
- Ball Clay
- Bentonite
- Borax; Boric Acid
- Caustic Soda
- Coal and Coal Coke
- Diatomaceous Earth
- Dumortierite
- Feldspar
- Ilmenite
- Kaolin
- Kyanite: Domestic
- Phosphate Rock
- Pinite
- Potter's Flint
- Pyrophyllite
- Salt
- Silicate of Soda
- Sillimanite: Domestic
- Soapstone
- Soda Ash
- Spodumene
- Stoneware Clay
- Sulfur
- Talc
- Waste Paper

If we lose, that day will never come

WE ARE known as a nation of thrifty "string-savers." Around our industrial plants are hoards of obsolete and obsolescing machinery and equipment, saved because "some day we might have use for it."

Today there *is* use for it, as desperately needed scrap, to make steel so that our fighting men will have the guns and tanks and ships they need. There will never be a better time to clear our plants of miscellaneous machines, old boilers, unused structures, unfinished parts, etc. Never will it be needed more.

Someone must be given the responsibility to decide what can be discarded throughout the entire plant, *and see that everything possible is scrapped.* Instead of saying, "But some day I may have use for it," let's remember that, If we lose, that day will never come!

(*Courtesy Inland Steel Co.*)

. . . the problem of getting required iron and steel scrap for next year's production will entail a deeper penetration than ever of the dormant scrap resources of industry, of the farm and of the heavier household metals. (From a recent WPB statement.)

Michigan Test Road Report

RECENTLY RECEIVED from the Michigan State Highway Department is a report on the Michigan Test Road covering a project of the State Highway Department in cooperation with the Public Roads Administration to evaluate the modern theories of design and construction of concrete pavements. The study also covers constituents of concrete which might affect its durability. This periodic report will undoubtedly be of interest to many of those concerned with the road and paving field. Copies can be obtained from the Michigan State Highway Department, the indicated price being $1.50.

Correction in Boiler Tube Emergency Provision EA-A 83

MEMBERS who have obtained copies of the new Compilation of A.S.T.M. Specifications for Steel Piping Materials or who have purchased copies in separate pamphlet form of the Standard Specification A 83 – 42 covering Lap-Welded and Seamless Steel and Lap-Welded Iron Boiler Tubes should make an important correction on the Emergency Alternate Provision (pink slip) affixed to the standard. This provision is intended to require the *stenciling* of the phrase "A.S.T.M. Specifications A 83" in addition to other marking in Section 17 (*a*), and the provision should not read "stamped" as printed. This pink slip will be correct, however, in the Book of Standards, and corrections will have been made on all additional copies sent from HEADQUARTERS after December 2.

In the A.S.T.M. boiler tube specifications, the required marking is to be put on the tube by paint stenciling, whereas by the word "stamped" is meant marking by means of a steel stamp, which in the case of the boiler tube specifications would introduce many problems.

WPB Limitation Orders on Steel Specifications

As a result of extensive work for over a year in the National Emergency Steel Specifications project, sponsored by the S.A.E., A.I.S.I., and A.S.T.M., the War Production Board has issued a general limitation order L-211 and appended two schedules to the order, one covering concrete reinforcement steel and the other steel wheels and tires. Other schedules are imminent and will be announced as they are developed.

Many of the A.S.T.M. Emergency Alternate Provisions as announced and published in this Bulletin in the field of pipe and tubing and in several other fields have resulted from the work of NESS technical advisory committees. The Society has issued the provisions not waiting for the issuance of formal WPB schedules since the requirements are in the interest of expediting procurement or conservation of critical materials. Many of these EA's ("pink slips") are being used even though formal WPB orders have not as yet been issued.

Since many members are concerned with the L-211 order and the schedules, they are published below. It is hoped to publish additional schedules as they are issued.

L-211

Part 3102—National Emergency Specifications for Steel Products

[Limitation Order L-211]

The fulfillment of requirements for the defense of the United States has created a shortage in the supply of steel for defense, for private account and for export; and the following Order is deemed necessary and appropriate in the public interest and to promote the national defense:

§ 3102.1 Limitation Order L-211—(a) *Issuance of schedules.* The Director General for Operations may, from time to time, issue schedules to this order establishing standards of sizes, shapes, specifications or other qualifications of steel products. From and after the effective date of any such schedule, no such material shall be produced, fabricated, delivered, accepted, or used except in accordance with such schedule.

(b) *Appeals.* Any person affected by this order, or any schedule hereto, and who considers that compliance therewith would disrupt or impair a program of war work may apply for relief by addressing a letter to the War Production Board, setting forth the pertinent facts and the reasons why such person considers that he is entitled to relief. The Director General for Operations may thereupon take such action as he deems appropriate.

(c) *Communications to the War Production Board.* All communications concerning any schedule to this Order shall, unless otherwise directed, be addressed to: War Production Board, Iron and Steel Branch, Washington, D. C., Reference: L-211, Schedule—.

(d) *Violations.* Any person who wilfully violates any provision of this order or of any schedule hereto, or who in connection with this order or any such schedule wilfully conceals a material fact or furnishes false information to any department or agency of the United States is guilty of a crime, and upon conviction may be punished by fine or imprisonment. In addition, any such person may be prohibited from making or obtaining any further deliveries of, or from processing or using, material under priority control and may be deprived of priorities assistance.

(P.D. Reg. 1, as amended, 6 F.R. 6680; W.P.B. Reg. 1, 7 F.R. 561; E.O. 9024, 7 F.R. 329; E.O. 9040, 7 F.R. 527; E.O. 9125, 7 F.R. 2719; sec. 2 (a), Pub. Law 671, 76th Cong., as amended by Pub. Laws 89 and 507, 77th Cong.)

Issued this 23rd day of October, 1942.

Ernest Kanzler,
Director General for Operations.

Part 3102—National Emergency Specifications for Steel Products

[Schedule 1 to Limitation Order L-211]

CONCRETE REINFORCEMENT STEEL

§ 3102.2 *Schedule 1 to Limitation Order L 211*—(a) *Definition.* For the purpose of this schedule, "Concrete reinforcement steel" means steel bars, wire, wire fabric, bar and rod mats, and steel spiral, used as reinforcement for concrete.

(b) *Restrictions in sizes and shapes.* No person shall produce, fabricate, or deliver concrete reinforcement bars and spirals except in the sizes and shapes set forth in Simplified Practice Recommendations R26-42 and R53-32, respectively, of the National Bureau of Standards.

(c) *Restrictions on specifications*—(1) *Government orders.* No person shall produce or fabricate for, or deliver to, the Government of the United States or any department or agency thereof, concrete reinforcement steel except as covered by any specification set forth in List 1 or 2 attached hereto.

(2) *Other orders.* No person shall produce or fabricate for, or deliver to, any person other than the Government of the United States or any department or agency thereof, concrete reinforcement steel except as covered by any specification set forth in List 1.

(d) *Acceptance of delivery.* No person shall accept delivery of concrete reinforcement steel produced, fabricated or delivered in violation of the provisions of paragraphs (b) or (c).

(e) *Exceptions.* The provisions of paragraphs (b), (c), and (d) shall not apply to concrete reinforcement steel:

(1) The production, fabrication, delivery, or acceptance of which is specifically permitted by the Director General for Operations, or

(2) Which has been produced or fabricated before the issuance date of this schedule, or which before such date has been processed in such manner and to such extent that processing to conform to such provisions would be impracticable, or

(3) Which, because of errors in production or fabrication, does not conform to the inspection or test requirements of the specifications prescribed in paragraph (c); provided such requirements are waived by the procuring agency or purchaser.

(f) *Records.* Each person owning or possessing concrete reinforcement steel excepted by the provisions of paragraph (e) shall retain records of such material available for inspection by duly authorized representatives of the War Production Board.

(P.D. Reg. 1, as amended, 6 F.R. 6680; W.P.B. Reg. 1, 7 F.R. 561; E.O. 9024, 7 F.R. 329; E.O. 9040, 7 F.R. 527; E.O. 9125, 7 F.R. 2719; sec. 2 (a) ,Pub. Law 671, 76th Cong., as amended by Pub. Laws 89 and 507, 77th Cong.)

Issued this 23rd day of October, 1942.

Ernest Kanzler,
Director General for Operations.

LIST 1.—SPECIFICATIONS GENERALLY PERMISSIBLE.

Billet steel bars Structural grade. Intermediate grade. Hard grade.	ASTM—A 15 – 39 Structural grade. Intermediate grade. Hard grade.	Billet steel bars for concrete reinforcement.
Rail steel bars	ASTM—A 16 – 35	Rail steel bars for concrete reinforcement.
Axle steel bars Structural grade. Intermediate grade. Hard grade.	ASTM—A 160 – 39 Structural grade. Intermediate grade. Hard grade.	Axle-steel bars for concrete reinforcement, as amended by Emergency Alternate Provisions EA – A 160 adopted April 6, 1942.
Cold-drawn wire reinforcement	ASTM—A 82 – 34	Cold-drawn steel wire for concrete reinforcement.
Bar and rod mats	ASTM—A 184 – 37	Fabricated steel bar or rod mats for concrete reinforcement.
Welded wire fabrics	ASTM—A 185 – 37	Welded steel wire fabric for concrete reinforcement.

Note.—ASTM = American Society for Testing Materials.

LIST 2.—SPECIFICATIONS PERMISSIBLE FOR GOVERNMENT ORDERS ONLY.

Billet steel bars Structural grade. Intermediate grade. Hard grade.	Federal—QQ-B-71 Grade 1. Grade 2. Grade 4.	Bars; reinforcement, (for) concrete.
Rail steel bars Hard grade.	Federal—QQ-B-71 Grade 5.	Bars; reinforcement, (for) concrete.
Axle steel bars Intermediate car-axle steel.	Federal—QQ-B-71 Grade 3.	Bars; reinforcement, (for) concrete as amended by Emergency Alternate Specification E-QQ-B-71a adopted June 2, 1942.

Note.—The applicable issue of the Specification in List 2 shall be the issue in effect on the date of the invitation to bid, or on the date of the purchase order or contract or such subsequent issue as the procuring agency may substitute in the contract.

PART 3102—NATIONAL EMERGENCY SPECIFICATIONS FOR STEEL PRODUCTS

[Schedule 2 to Limitation Order L-211]

STEEL WHEELS AND TIRES

§ 3102.3 *Schedule 2 to Limitation Order L-211*—(a) *Definitions.* For the purposes of this schedule:

(1) "Steel wheels" means rolled, forged, and spun steel wheels for railroad and transit service.

(2) "Steel tires" means wrought steel tires for railroad and transit service.

(b) *Restrictions on sizes and shapes.* On and after the 60th day after the date of issuance of this schedule, no person shall produce, fabricate, or deliver steel wheels except in the sizes and shapes set forth in the Association of American Railroads, Tables 1 and 2 adopted April 29, 1942, and Table 3 adopted April 29, 1942, and revised September 1, 1942, which form a part of Specification E-M-107-42, adopted April 16, 1942, and in American Society for Testing Materials Specifications A 25 – 41, as amended by emergency alternate provisions EA – A 25a adopted August 24, 1942.

(c) *Restrictions on specifications*—(1) *Steel wheels.* On and after the date of issuance of this schedule, no person shall produce, fabricate, or deliver steel wheels except to the specifications set forth in List 1 attached hereto.

(2) *Steel tires.* On and after the date of issuance of this schedule, no person shall produce, fabricate, or deliver steel tires except to the specifications set forth in List 2 attached hereto.

(d) *Acceptance of delivery.* No person shall accept delivery of steel wheels or steel tires produced, fabricated, or delivered in violation of the provisions of paragraph (b) or (c).

(e) *Exceptions.* The provisions of paragraphs (b), (c), and (d) shall not apply to steel wheels or steel tires:

(1) The production, fabrication, delivery, or acceptance of which is specifically permitted by the Director General for Operations, or

(2) Which have been produced or fabricated before the effective date of the applicable provision, or which before such date have been processed in such manner and to such extent that processing to conform to such provision would be impracticable, or

(3) Which, because of errors in production or fabrication, do not conform to the requirements of paragraph (b) or to the inspection or test requirements of the specifications prescribed in paragraph (c), provided such requirements are waived by the procuring agency or purchaser.

(f) *Records.* Each person owning or possessing steel wheels or steel tires excepted by the provisions of paragraph (e) shall retain records of such material available for inspection by duly authorized representatives of the War Production Board.

(P.D. Reg. 1, as amended, 6 F.R. 6680; W.P.B. Reg. 1, 7 F.R. 561; E.O. 9024, 7 F.R. 329; E.O. 9040, 7 F.R. 527; E.O. 9125, 7 F.R. 2719; sec. 2 (a), Pub. Law 671, 76th Cong., as amended by Pub. Laws 89 and 507, 77th Cong.

Issued this 23rd day of October, 1942.

ERNEST KANZLER,
Director General for Operations.

LIST 1.—RAILROAD WHEELS.

Transit service:		
Wrought steel wheels	ASTM—A 25 – 41	Wrought steel wheels for electric railway service, as amended by Emergency Alternate Provision EA – A 25a adopted August 24, 1942.
Spun steel wheels	ASTM—A 25 – 41	Wrought steel wheels for electric railway service, as amended by Emergency Alternate Provision EA – A25a adopted August 24, 1942.
Railroad service:		
Multiple wear type	AAR—E-M-107-42	Wheels, multiple wear wrought steel.
One wear type	AAR—E-M-103-42	One-wear wrought steel wheels.
Heat-treated multiple wear type	AAR—E-M-123-42	Heat-treated multiple wear wrought carbon steel wheels.
Export, industrial, and miscellaneous service:		
Multiple wear type	ASTM—A 57 – 39	Multiple-wear wrought steel wheels, as amended by Emergency Alternate Provision EA – A 57 adopted June 22, 1942.

LIST 2.—STEEL TIRES FOR LOCOMOTIVES AND CARS.

Domestic service	AAR—E-M-106-42	Tires, steel, locomotives, and car.
Carbon 0.50–0.65%	Class A.	
Carbon 0.60–0.75%	Class B.	
Carbon 0.70–0.85%	Class C.	
Export service	ASTM—A 26 – 39	Steel tires, as amended by Emergency Alternate Provision EA – A 26, adopted April 28, 1942.
Carbon 0.50–0.65%	Class A.	
Carbon 0.60–0.75%	Class B.	
Carbon 0.70–0.85%	Class C.	
Heat-treated tires	AAR—E-M-124-42	Tires, heat-treated steel.
Carbon 0.52–0.62%	Class A.	
Carbon 0.62–0.72%	Class B.	
Carbon 0.72–0.82%	Class C.	
Carbon 0.72–0.82%	Class D.	

NOTE.—AAR = Association of American Railroads. ASTM = American Society for Testing Materials.

Amount of Steel for Mill Buildings

AN EXTENSIVE study of the amount of steel required for mill buildings has been completed by the Specifications Branch, Conservation Division, War Production Board. The primary purpose was to determine those types of roof construction for steel mill buildings, which, for a variety of conditions, require the least amounts of steel in the over-all design from roof to footings. The study should be of assistance to designing engineers in selecting that type of roof which is adequate and, yet, involves the least amount of steel in the entire building.

Not only were various types of roof construction studied but the total amount of steel required for a typical bay in a steel mill building—both with and without a crane—including the steel in the trusses, bracing between trusses, crane girders, columns and footings, was determined. The information in the report, copies of which can be obtained from the Conservation Division, 11th and H Sts., N. W., Washington, D. C., are to be regarded as advisory or informational in character only.

In addition to some seven types of construction, that is, with various roofing materials supported by steel columns, studies were made of mill buildings with wood trusses on wood columns.

WPB Order Helps Laboratories

RESEARCH LABORATORIES have been given assistance to secure a continuing supply of reagent chemicals, laboratory equipment, and other materials by the revision of the existing Preference Rating Order, P-43 and the issuance, effective as of Nov. 5, of a new Preference Rating Order, P-135, by the Director General for Operations.

Order P-43, as revised, now is expanded to cover qualified production control as well as research laboratories, and assigns to all laboratories holding a serial number under P-43 a rating of AA-2X for the purchase of equipment, reagent chemicals, and other materials. For material costing more than $50 except reagent chemicals specific authorization by the WPB is required to apply the rating. Such authorization is to be applied for on Form PD-620, and all holders of serial numbers must file Form PD-93 by the 15th of each month.

The order also assigns a rating of AA-4 to deliveries of laboratory equipment to a laboratory not assigned a serial number. Deliveries under this provision must be authorized by WPB.

Order P-135 enables laboratories not holding serial numbers under P-43 to use a rating of AA-2X for chemicals used for analytical, testing, control, educational, or re-

search purposes. Laboratories, other than those specifically approved under P-43, may use this rating to buy from supply houses, to purchase from manufacturers, and manufacturers to buy raw materials for the production of reagent chemicals.

Partial List of Emergency Alternate Federal Specifications

FROM THE VERY large list of Emergency Alternate Specifications received at A.S.T.M. Headquarters there has been selected many which it is believed would be of concern to a reasonable cross-section of the Society's membership and the titles of these are given below. Constantly these emergency specifications are being issued, some to supersede previously issued emergency documents—in all cases, of course, the object is to expedite procurement or to conserve strategic or critical materials.

Partial List of Emergency Alternate Federal Specifications

Specification Number	Description
E-DDD-C-51a	Carpets and Rugs; Axminster
E-DDD-C-61b	Carpets and Rugs; Velvet, Plain, and Twisted-Pile
E-DDD-C-71a	Carpets and Rugs; Wilton
E-DDD-R-751	Rugs; American-Oriental (Washed)
E-GG-S-776	Straightedges; Steel
E-J-C-103	Cable and Wire; Rubber-Insulated, Building-Type (0 to 5000-Volt Service) (superseding E-J-C-103, dated March 31, 1942)
E-K-P-146	Paulins and Covers; Duck (Tarpaulins)
E-QQ-A-334	Aluminum-Alloy (Aluminum-Chromium-Magnesium-Silicon); Plates and Sheets (superseding E-QQ-A-334, dated October 15, 1941)
E-QQ-A-351a	Aluminum-Alloy (Aluminum-Copper-Magnesium-Manganese); Bars, Rods, Shapes, and Wire (superseding E-QQ-A-351a, dated August 25, 1942)
E-QQ-A-353a	Aluminum-Alloy (Al-17), (Aluminum-Copper-Magnesium-Manganese); Plates, Sheets, and Strips (superseding E-QQ-A-353a, dated October 15, 1941)
E-QQ-A-355a	Aluminum-Alloy (Al-24), (Aluminum-Copper-Magnesium (1.5 per cent) Manganese); Plates, Sheets, and Strips (superseding E-QQ-A-355a, dated October 15, 1941)
E-QQ-A-356a	Aluminum-Alloy (Aluminum-Manganese); Bars, Rods, Shapes and Wire (superseding E-QQ-A-356a, dated August 19, 1942)
E-QQ-A-359a	Aluminum-Alloy (Aluminum-Manganese); Plates and Sheets (superseding E-QQ-A-359a, dated August 16, 1941)
E-QQ-A-367a	Aluminum-Alloy; Forgings, Heat-Treated (superseding E-QQ-A-367a, dated October 15, 1941)
E-QQ-A-411a	Aluminum; Bars, Rods, Shapes, and Wire (superseding E-QQ-A-411a, dated August 16, 1941)
E-QQ-A-561	Aluminum, Plates and Sheets (superseding E-QQ-A-561, dated August 16, 1941)
E-QQ-A-591	Aluminum-Base-Alloy; Die-Castings (superseding E-QQ-A-591, dated August 25, 1942)
E-QQ-A-596	Aluminum-Base-Alloy; Permanent-Mold-Castings (superseding E-QQ-A-596, dated October 15, 1941)
E-QQ-A-601	Aluminum-Base-Alloys; Sand-Castings (superseding E-QQ-A-601, dated June 10, 1942)
E-QQ-B-611a	Brass, Commercial; Bars, Plates, Rods, Shapes, Sheets, and Strips (superseding E-QQ-B-611a, dated September 16, 1941)
E-QQ-B-636	Brass, Naval; Bars, Plates, Rods, Shapes, Sheets, and Strips (superseding E-QQ-B-636, dated September 16, 1941)
E-QQ-B-691a	Bronze; Castings (superseding E-QQ-B-691a, dated March 31, 1942)
E-QQ-B-726a	Bronze, Manganese; Castings (superseding E-QQ-B-726a, dated September 16, 1941)
E-QQ-W-414	Wire, Steel; Bookbinders (superseding E-QQ-W-414, dated February 4, 1942)
E-RR-C-92	Cans; Safety (for Gasoline, Naphtha, Etc.)
E-RR-R-571	Rope; Wire (superseding E-RR-R-571, dated June 2, 1942)
E-T-M-561a	Mops; Cotton (superseding E-T-M-561a, dated July 9, 1942)
E-TT-A-468	Aluminum-Pigment; Powder and Paste (for) Paint (superseding E-TT-A-466 and E-TT-A-476, dated August 13, 1941)
E-TT-P-36a	Paints; Lead-Zinc-Base, Ready-Mixed, and Semi-Paste, White and Tinted (superseding E-TT-P-36a, dated February 24, 1942)
E-TT-P-59	Paint; Ready-Mixed, International-Orange (superseding E-TT-P-59, dated February 24, 1942)
E-TT-P-86	Paint, Red-Lead-Base; Linseed-Oil, Ready-Mixed (superseding E-TT-P-86, dated February 24, 1942)
E-TT-P-101a	Paint; Titanium-Zinc and Titanium-Zinc-Lead, Outside, Ready-Mixed, White (superseding E-TT-P-101a, dated April 25, 1942)
E-TT-P-115	Paint; Traffic, Exterior, White and Yellow (White Traffic Paint Only)
E-TT-P-156	Paint, White-Lead-Base; Basic-Carbonate, Ready-Mixed, Light-Tints and White (superseding E-TT-P-156, dated February 24, 1942)
E-TT-P-791a	Putty; Pure-Linseed-Oil, (for) Wood-Sash-Glazing
E-TT-V-121a	Varnish; Spar, Water-Resisting (superseding E-TT-V-121a, dated September 30, 1941)
E-WW-C-623	Couplings; Hose, Garden and Water (superseding E-WW-C-623a, dated May 8, 1942)
E-WW-C-626	Couplings; Hose, Oil-Suction and Discharge (superseding E-WW-C-626, dated May 8, 1942)
E-WW-C-636	Couplings; Hose, Steam
E-WW-C-646	Couplings; Hose, Water-Suction (superseding E-WW-C-646, dated May 8, 1942)
E-ZZ-H-451	Hose, Fire; Cotton, Rubber-Lined (superseding E-ZZ-H-451, dated June 23, 1942)
E-ZZ-H-511	Hose; Radiator, (for) Motor Vehicles
E-ZZ-H-601	Hose; Water, Braided (superseding E-ZZ-H-601, dated July 28, 1942)
E-ZZ-H-611	Hose; Water, Wrapped (superseding E-ZZ-H-611, dated April 9, 1942)
E-ZZ-M-46	Mats, Floor; Rubber, Link-Type
E-ZZ-S-311a	Sheeting; Rubber (superseding E-QQ-S-311a, dated May 29, 1942)

Technique of Plywood

RECENTLY RECEIVED is a publication on "Technique of Plywood" prepared by C. B. Norris of the Lauxite Corp., comprising a reprint of a series of recently issued articles. The contents are divided into five sections as follows: strength, deformation, and elastic stability of plywood sheets; elastic theory of wood and plywood; manufacture; warpage; and bending, molding, and embossing. This 250-page publication should be of direct interest to all those concerned with this field which is rapidly becoming of such increasing significance. Published by I. F. Laucks, Inc., Seattle, Wash., copies can be obtained at \$2.50 each, postage prepaid in the United States. The book is substantially bound in plastic ring binder, page size $4^1/_2$ by $7^1/_2$ in.

ASTM Bulletins—1942

Subject Index

Papers and Reports

National Emergency Specifications for the Design of Reinforced Concrete Buildings

Copies of the National Emergency Specifications for the Design of Reinforced Concrete Buildings, which were established by the WPB through Directive No. 9, can be obtained from P. H. Colby, WPB, Room 1310, Railroad Retirement Building (Phone Republic 7500, Ext. 4911), but requests for more than 25 copies should be made to W. L. Wyckoff, WPB, Room 1090, Railroad Retirement Building (RE 7500, Ext. 74483). These specifications which were developed under the direction of the Specifications Branch, WPB Conservation Division, cover the use of reinforcing steel for all buildings which are constructed, financed or approved by governmental agencies on contracts placed after December 4, 1942.

The purpose of the directive is to conserve the supply of reinforcing steel by requiring the use of larger structural members and higher unit tensile stresses in reinforcing steel than normally are used in the design of reinforced concrete buildings. By using the stresses set forth in the specifications, there will be a considerable reduction in the amount of reinforcing steel used in concrete buildings, but not to an extent that will in any way endanger the safety of the buildings.

The allowable compressive unit stresses in concrete have been reduced, thus requiring larger structural members, with corresponding reductions in the amount of steel needed. Further economy in the use of reinforcing steel is obtained by increasing the allowable unit tensile stress from 18,000 psi. to 20,000 psi. for structural grade bars and from 20,000 psi. to 24,000 psi. for intermediate and hard grade bars.

New Book on Colloidal and Amorphous Materials

THIS OUTSTANDING 560-page publication in the words of the author "is the embodiment of the result of 25 years' teaching at the Massachusetts Institute of Technology" with the text prepared entirely by members of its staff, all but one of whom have gone into industry. The authors, Messrs. Warren K. Lewis, Lombard Squires, and Geoffrey Broughton, have covered many of the perplexing subjects involved in a manner which makes the book easily readable throughout, and by a profuse selection of charts and line drawings with appropriate typographical arrangement by the printer, an excellent publication has resulted.

Throughout emphasis is placed on the industrial aspects of these materials and an attempt is made to give an insight into the underlying phenomena so that an appreciation will be developed of the possibilities and limitations of processes and materials involved. The first part of the book presents considerable basic material. The authors attempt to make clear the interrelationships of the colloidal and amorphous state and emphasize phases of the problems in industry likely to become important in the near future. The necessity of maintaining breadth of view in this field of physical science is stressed. As an example the authors cite new concepts of the structure of rubber which have come about in no small measure due to new facts on other materials. In this case light is thrown on one industry by data from another. To stimulate an appreciation of these interrelationships extensive cross references are given throughout the text with brief bibliographies at the end of each chapter. The first 12 chapters of the book cover the following: structure of liquids, viscosity, surface tension, surface tension and orientation, adsorption, suspensoids, amorphous solids, emulsoids, electrochemical behavior of colloids, gelation, emulsions and foams and crystalline and amorphous states. The remaining chapters of the book pertain to the following: thermoplastics, glass, plasticization by solution, paper, the plastic fibers, leather, rubber, ceramic industries, synthetic resins and plastics, and textile fibers. In addition to a detailed subject index an author index is included. Copies can be obtained from the MacMillan Co., 60 Fifth Ave., New York, N. Y., at $5.50 each.

Catalogs and Literature Received

AMERICAN INSTRUMENT CO., 8010–8020 Georgia Ave., Silver Spring, Md. Bulletin No. 2109, a four-page folder describing the new McKee Wear Gage for measuring the amount of material removed from metallic surfaces after the surfaces have been subjected to wear, abrasion, grinding, honing, lapping, etc. Illustrated.

LEEDS & NORTHRUP CO., 4934 Stenton Ave., Philadelphia, Pa. Catalog N-33A, 56 pages, well illustrated, entitled "Micromax Thermocouple Pyrometers." This book tries to cut correspondence and give wartime pyrometer users first hand the information they want about available instruments—indicators, recorders and controllers—and about the thermocouples and accessories which are used with them.

SCIENTIFIC GLASS APPARATUS CO., Bloomfield, N. J. A 15-page folder entitled "Modern Apparatus for the Modern Laboratory" describes steam-heated hot plate, laboratory heaters, vari-heat racks, twin-unit portable multi-tube distillation racks, multi-duty electric funnel, heater and bath, stirrers, water baths, laboratory pumps, gas burners, constant temperature baths, and ball bearing electric centrifuges. Illustrated.

Also, Bulletin No. 41-55, entitled "Burettes," 15 pages, illustrated. Describes various kinds of burettes of the inter-joint type, from the student grade to theprecisi on research models; from simple graduated tubes to patented all automatic burette.

W. H. & L. D. BETZ, Gillingham and Worth Sts., Philadelphia, Pa. A 20-page booklet entitled "Apparatus and Chemicals for Water Analyses" (a Supplement to the *Water Handbook*) includes equipment and reagents necessary for the more common water analyses. The book features the tests sets required for such determinations as hardness, alkalinity, phosphate, sulfate, etc. Illustrated.

CORNING GLASS WORKS, Corning, N. Y. Supplement No. 1 to Catalog LP21, issued August 20, 1942—"New Items in Pyrex Laboratory Glassware Including Lifetime Red Low Actinic Glassware"—15-page booklet, illustrated. Also, Supplement No. 2 to Catalog LP21, issued November 2, 1942—"Prices and Discounts—Pyrex Tubing and Rod."

GEORGE SCHERR CO., INC., 128 Lafayette St., New York, N. Y. An eight-page folder showing time-saving devices for the grinding room including descriptions of Magne-Blox products, Magnetic Parallels used on magnetic chucks for holding work for surface grinding operations and Radius Dresser for dressing radii from 0 to 1 in. Illustrated.

Calendar of Society Meetings

(Arranged in Chronological Order)

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE—Annual Winter Meeting, December 28–January 2, 1943, Hotel Commodore, New York, N. Y.

SOCIETY OF AUTOMOTIVE ENGINEERS—War Production-Engineering Meeting and Engineering Display, January 11–15, Book-Cadillac Hotel, Detroit, Mich.

AMERICAN SOCIETY OF CIVIL ENGINEERS—Annual Meeting, January 20–21, Engineering Societies Building, New York, N. Y.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS—Annual Meeting, January 25–27, Hotel Gibson, Cincinnati, Ohio.

NATIONAL CRUSHED STONE ASSOCIATION—Annual Convention, January 25–27, Hollenden Hotel, Cleveland, Ohio.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—National Technical Meeting, January 25–29, Engineering Societies Building, New York, N. Y.

NATIONAL SAND AND GRAVEL ASSOCIATION—Annual Convention, January 27–29, Hotel Statler, Cleveland, Ohio.

THE ENGINEERING INSTITUTE OF CANADA—Fifty-seventh Annual General Meeting, February 11–12, Royal York Hotel, Toronto, Canada.

STEEL FOUNDERS SOCIETY OF AMERICA—Annual Meeting, February 12–13, Edgewater Beach Hotel, Chicago, Ill.

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS—Annual Meeting, February 14–18, Engineering Societies Building, New York, N. Y.

TECHNICAL ASSOCIATION OF PULP AND PAPER INDUSTRY—Annual Meeting, February 15–18, Hotel Commodore, New York, N. Y.

AMERICAN CONCRETE INSTITUTE—Annual Convention, February 17 and 18, Chicago, Ill.

American Society for Testing Materials—Committee Week and Spring Meeting, March 1–5, Hotel Statler, Buffalo, N. Y.; Forty-sixth Annual Meeting, June 28–July 2, William Penn Hotel, Pittsburgh, Pa.

AMERICAN RAILWAY ENGINEERING ASSOCIATION—Annual Convention, March 16–18, Chicago, Ill.

AMERICAN CERAMIC SOCIETY—Forty-fifth Annual Meeting, Week of April 18, Hotel William Penn, Pittsburgh, Pa.

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION—Spring Meeting, April 20–23, Chicago, Ill.

AMERICAN WOOD PRESERVERS' ASSOCIATION—Thirty-ninth Annual Meeting, April 27–29, Cincinnati, Ohio.

Dean Harvey Honored by Westinghouse

Dean Harvey, Vice-President of the Society, and Materials Engineer, Engineering Laboratories and Standards Dept., Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa., who also is Chief, Electrical and Mechanical Section, Specifications Branch, WPB Conservation Division, has been given the Westinghouse Award of Merit by the Board of Directors of the Westinghouse organization. The citation on the certificate reads as follows:

"In recognition of the distinguished service of Dean Harvey for pioneering work in the development of materials and process specifications both within the company and for national organizations; for his notable work in connection with insulating oils and his insistance on suitable correlation between laboratory and service tests; and for his recent contributions to the war effort in the Conservation Division of the War Production Board."

Louis H. Winkler Presents Mordica Lecture

At the 1942 annual convention of the Wire Association held in Cleveland, Louis H. Winkler, a very active A.S.T.M. member, Metallurgical Engineer, Bethlehem Steel Co., Inc., Bethlehem, Pa., delivered the Mordica Memorial Lecture on the subject "Steel and Wire." This lecture is given in memory of John Mordica, first president of the Wire Association, who was Superintendent of the Wire and Rod Mills, Bethlehem Steel Co. at Sparrows Point, Md. The lecturer, selected by the board of trustees, is one who has rendered notable service to the industry, and who, through the lecture is in a position to present a thesis of outstanding interest to the operating men of the industry. Two other A.S.T.M. members have presented lectures: S. A. Braley, Pittsburgh Steel Co., in 1939, and B. L. McCarthy, Wickwire Spencer Steel Co., in 1940. Mr. Winkler's lecture will be published in the January issue of the journal *Wire and Wire Products*.

PERSONALS

. . . News items concerning the activities of our members will be welcomed for inclusion in this column.

E. O. Reese, formerly Factory Manager, Reese Padlock Co., Lancaster, Pa., is now Process Engineer, U. S. Rubber Co., Eau Claire Ordnance Plant, Eau Claire, Wis.

L. A. Melsheimer is now Director, Paint Development and Service, Thompson, Weinman and Co., Inc., New York, N. Y. He was connected with the Sales Technical Service, United Color and Pigment Co., Newark, N. J., as Chemist.

W. D. Brown, who was Research Engineer, Western Waterproofing Co., Detroit, Mich., is now Research Engineer, Chrysler Corp., Detroit.

W. D. Kiehle is now an Ensign in the U. S. Navy. Formerly he was Engineer, Eastman Kodak Co., Rochester, N. Y.

H. L. Howe, who is City Engineer of Rochester, N. Y., has been elected President of the American Public Works Association.

W. L. Collins, who is an Assistant Professor, Department of Theoretical and Applied Mechanics, University of Illinois, Urbana, Ill., is now First Lieutenant, Ordnance Department, Training Methods Section, The Ordnance School, Aberdeen Proving Ground, Md.

Julius Avins, formerly Development Engineer, The Solvay Process Co., Hopewell, Va., is now Engineer, General Chemical Co., Engineering Division, Camden, N. J.

B. J. Lazan is now Research and Testing Engineer, Sonntag Scientific Equipment Corp., Greenwich, Conn. He was formerly Assistant Professor, Department of Engineering Mechanics, The Pennsylvania State College, State College, Pa.

H. V. Smith is connected with Synthetic Rubber Projects, The Lummus Co., New York, N. Y., as Job Engineer. He was Chief Chemical Engineer, and Head of Technical Department, Barber Asphalt Corp., Barber, N. J.

A. K. Graham of A. Kenneth Graham and Associates, Jenkintown, Pa., is now Chief, Non-Metals and Industry Section, Conservation and Substitution Branch, Conservation Division, WPB, Washington, D. C.

At the recent meeting of the Association of Consulting Chemists and Chemical Engineers, Inc., the election of new officers and directors was announced, and the following A.S.T.M. members have been elected: *President*, H. P. Trevithick, Chief Chemist, New York Produce Exchange, New York, N. Y.; *Secretary*, W. C. Bowden, Jr., Chief Chemist, Ledoux & Co., Inc., New York, N. Y.; *Directors:* P. P. Gray, Chief Chemist, Wallerstein Laboratories, New York, N. Y.; I. F. Laucks, President, Laucks Laboratories, Inc., New York, N. Y.; and C. A. Crowley, President and Director of Laboratory, Technical Service Bureau, Inc., Chicago, Ill.

C. B. Karns, Vice-President, Penola, Inc., and Manager, Standard Oil Co. of Pennsylvania, Pittsburgh, Pa., has been elected President of the National Lubricating Grease Institute for the ensuing year. Election took place at the Tenth Annual Meeting of the Institute in New Orleans in October.

N. E. Woldman, Chief Metallurgical Engineer, Eclipse Aviation Division, Bendix Aviation Corp., Bendix, N. J., has consented to head the newly organized Aluminum and Magnesium Division of the American Foundrymen's Association. The new division has been organized to study the foundry practices involved in the casting of aluminum and magnesium alloys.

P. R. Cassidy, formerly Executive Assistant, The Babcock & Wilcox Co., New York, N. Y., is now Lieutenant Colonel in the Engineer Corps, U. S. Army.

G. M. Kline, Chief, Organic Plastics Section, National Bureau of Standards, recently returned from Great Britain, where he spent a month observing developments in war applications of plastics. During his visit he was guest speaker at luncheon meetings of the British Plastics Federation, the Plastics Group of the Society of Chemical Industry, and the annual meeting of the Institute of the Plastics Industry in London. Doctor Kline made the trip as a representative of the U. S. Government in response to an invitation from the British Ministry of Supply.

R. E. Wilson, President, Pan American Petroleum and Transport Co., New York, N. Y., has been selected to receive the Perkin Medal of the Society of Chemical Industry for 1943. This medal is awarded annually for outstanding work in applied chemistry and the medalist is selected by a committee representing the five chemical societies in the United States. The medal will be presented on January 8, 1943, at a meeting to be held at The Chemists' Club, New York.

T. A. Boyd, Head, Fuel Department, Research Laboratories Division, General Motors Corp., Detroit, Mich., and Thomas Midgley, Jr., Vice-President, Ethyl Corp., Worthington, Ohio, have been proposed by the Local Sections of the American Chemical Society for nomination for President-Elect and for Councilor-at-Large, respectively.

News Notes About A.S.T.M. Members in the A.S.M.—At the recent Metal Congress of the American Society for Metals several A.S.T.M. members were honored as follows: H. J. French, In Charge, Alloy Iron and Steel Development, The International Nickel Co., Inc., New York, N. Y., and Senior Technical Consultant in Charge of Metallurgical and Technical Specifications Section, Iron and Steel Branch, WPB, was elected *President* for the coming year, and M. A. Grossmann, Director of Research, Carnegie-Illinois Steel Corp., Chicago, Ill., *Vice-President*. J. P. Gill, Chief Metallurgist, Vanadium-Alloy Steel Co., Latrobe, Pa., was presented a lecture course certificate for his authorship of a lecture series on tool steels, and the past-presidents' medal was awarded O. E. Harder, Assistant Director, Battelle Memorial Institute, Columbus, Ohio.

News Notes About A.S.T.M. Members in the A.W.S.—At the annual meeting of the American Welding Society the following A.S.T.M. members were honored: David Arnott, Chief Surveyor, American Bureau of Shipping, New York, N. Y., became *First Vice-President;* O. B. J. Fraser, Director of Technical Service on Mill Products, The International Nickel Co., New York, N. Y., was reelected *Treasurer;* J. H. Critchett, Vice-President, Union Carbide and Carbon Research Laboratories, Inc., New York, N. Y., elected *Director-at-Large*. The Samuel

Wylie Miller Memorial award of the A.W.S. was given to H. C. BOARDMAN, Research Engineer, Chicago Bridge & Iron Co., Chicago, Ill.

NEWS NOTES ABOUT A.S.T.M. MEMBERS IN THE A.I.M.E.—Recently the American Institute of Mining and Metallurgical Engineers has honored the following A.S.T.M. members by election to the indicated offices:

C. H. MATHEWSON, Professor of Metallurgy, Hammond Laboratory, Sheffield Scientific School, Yale University, New Haven, Conn., *President and Director*.

H. J. BROWN, Consulting Engineer, Boston, Mass., and F. E. WORMSER, Secretary and Treasurer, Lead Industries Assn., New York, N. Y., *Directors*.

C. E. REISTLE, JR., Engineer in Charge, Petroleum Engineering Department, Humble Oil & Refining Co., Houston, Texas, *Associate Chairman*, and M. L. HAIDER, Chief Petroleum Engineer, Standard Oil Development Co., New York, N. Y., *Member of Executive Committee*, Petroleum Division, and WALTER MILLER, Vice-President in Charge of Manufacturing, Continental Oil Co., Ponca City, Okla., *Chairman* of Committee for Refinery Engineering of the Petroleum Division.

CYRIL STANLEY SMITH, Research Supervisor, War Metallurgy Committee, National Research Council, Washington, D. C., *Chairman*, ARTHUR PHILLIPS, Professor of Metallurgy, Hammond Laboratory, Yale Universty New Haven, Conn., *Vice-Chairman*, and F. T. SISCO, Assistant Secretary, A.I.M.E., New York, N. Y., *Secretary*, Institute of Metals Division.

A. F. GREAVES-WALKER, Acting Director, State College Station, North Carolina State College, Engineering Experiment Station, Raleigh, N. C., and Chief, Nonmetals Section, WPB, *Chairman*, A.I.M.E. Mineral Industry Education Division.

A. W. GAUGER, Director, Mineral Industries Research, The Pennsylvania State College, State College, Pa., *Vice-Chairman*, Coal Division.

N. C. ROCKWOOD, President and Editor, *Rock Products*, Chicago, Ill., *Vice-Chairman*, Industrial Minerals Division.

H. R. MAUERSBERGER, Technical Editor, Rayon Publishing Corp., New York, N. Y., has been honored through the selection of his paper presented at the October, 1940, meeting of Committee D-13 for publication as an outstanding investigative report during that year in the 1941 report of the Smithsonian Institution. This is the first textile report reproduced by the Institution in a number of years. The paper covers "The New Synthetic Textile Fibers."

H. M. BIGELOW, Director of Technical Service, Plaskon Co., Inc., Toledo, O., is now serving as Captain, Chemical Warfare Service, Research and Development, Edgewood Arsenal, Md.

A. R. DIMOCK, JR., formerly Assistant Engineer, Ford, Bacon & Davis, New York, N. Y., is now Engineer, Petro-Chem Development Co., New York, N. Y.

E. R. MELLENGER who was Surveyor, Lloyd's Register of Shipping, Buffalo, N. Y., is with the British Ministry of War Transport, New York, N. Y.

The National Paint Dictionary

THE SECOND EDITION of this publication by Jeffrey R. Stewart is intended as a reference volume for chemists, productions managers, purchasing agents, distributors, and all those concerned with the manufacture, consumption, and application of paint and related products. The books contain definitions of terms and pertinent information on chemicals, raw materials, equipment, and apparatus employed. The author has obtained the opinions and reactions of many in the paint field in preparing this publication. The supplementary section in the book gives useful information in convenient reference form. To keep the book up to date, the National Paint Bulletin of which Mr. Stewart is Editor and Publisher, will give new definitions monthly.

Copies of this 224-page book (9- by 12-in. page size) can be obtained from the Stewart Research Laboratory, 1340 New York Ave., N. W., Washington, D. C., at $7.50 each.

EDITOR'S NOTE.—When Emergency Alternate Provisions are themselves modified, this situation is indicated at the end of the designation by use of the letters a, b, c, etc.

EA - A 25a

Issued, August 24, 1942
(Superseding Issue of June 22, 1942)

The following Emergency Alternate Provisions, when specified, may be used as alternates in A.S.T.M. Standard Specifications for Wrought Steel Wheels for Electric Railway Service (A 25 - 41) and affect only the requirements referred to:

Section 4.—Change the requirement for sulfur from "0.05 max., per cent" to read as follows:

Sulfur, max., per cent { basic steel....0.05; acid steel....0.06

Also in Section 4, add a footnote *a* after the manganese requirement of 0.60 to 0.85 per cent to read as follows:

[a] For spun steel wheels (see Appendix I) the manganese content shall not exceed 1.60 per cent.

Section 8.—Change Paragraphs (*i*) and (*j*) to read as follows:

(*i*) *Thickness of Plate.*—The dimensions of the plate may vary but shall not be less than that shown in the Table of Standard Designs, Appendix II.

(*j*) *Diameter of Hub.*—The thickness of wall of finished bored hub shall not be less than that shown in the Table of Standard Designs, Appendix II. The outside diameter shall not exceed that specified by more than 3/4 in. The thickness of the hub wall in any wheel shall not vary more than 3/8 in. at any two points equidistant from the face of the hub.

Table I.—Change items (*i*) and (*j*) on Thickness of Plate and Diameter of Hub, respectively, in accordance with revised Paragraphs (*i*) and (*j*) of Section 8.

Section 9.—Add the following as a new Paragraph (*a*), relettering the remaining paragraphs accordingly:

(*a*) Wheels shall be rough bored and faces of hubs machined. The contour of tread and flange shall be as specified.

Section 10 (a).—In this Section on Marking, add the phrase "or cast in raised letters" after the words "legibly stamped."

Appendices.—Add the following as Appendices I and II:

APPENDIX I. SPUN STEEL WHEELS

Spun steel wheels are usable for electric railway service similar to wrought steel wheels, providing the spun wheels conform to the foregoing specifications for wrought steel wheels.

Spun steel wheels must be manufactured in a manner capable of producing and maintaining high centrifugal fluid compression forces by a high rate of spinning during the entire period in which solidification of metal takes place.

APPENDIX II. WHEEL DESIGN

The following Tables* of Dimensions of Standard Steel Wheel Designs, adopted July 30, 1942, by the American Transit Engineering Association, are hereby made a part of Specifications A 25 - 41 as amended by Emergency Alternate Provisions EA - A 25a. The tables are reprinted with permission.

EA - B 86a

(Tentative Specifications for Zinc-Base Alloy Die Castings (B 86 - 41 T))
Issued, October 19, 1942

This Emergency Alternate Provision modifies a previous Emergency Provision by limiting the copper content of alloy No. XXIV to 0.25 per cent, instead of the present 0.40 max. in EA - B 86. This alloy No. XXIV is an emergency alternate for regular alloy No. XXIII that is intended to conserve aluminum. The maximum copper content of alloy No. XXIII in the Tentative Specifications B 86 - 41 T is 0.10.

* These extensive tables are not included with the provisions in this BULLETIN, but are printed with the provision as issued separately in the form of pink slips.

Complete List of A.S.T.M. Emergency Specifications and Emergency Alternate Provisions

EDITOR'S NOTE.—To provide a readily accessible and convenient reference for members who wish to have a complete list of all emergency specifications and emergency alternate provisions (pink slips) each issue of the BULLETIN will give the latest list at the time the BULLETIN goes to press. This feature suggested by the Executive Committee will appear as the last page or two of BULLETIN text immediately preceding the professional card page in the back advertising section.

November 25, 1942

Emergency Specifications for[1]

ES-1a Lead-Coated and Lead-Alloy Coated Copper Wire for Electrical Purposes.
ES-2 Lead Coating (Hot-Dip), on Iron or Steel Hardware.
ES-3 Conducting Salt Spray Tests on Organic Protective Coatings. (Method)
ES-4 *Discontinued*, Replaced by Standard Hardness Conversion Table for Cartridge Brass. (Relationship Between Diamond Pyramid Hardness, Rockwell Hardness, and Brinell Hardness) (E 33-42)
ES-5a Carbon-Chromium Ball and Roller-Bearing Steels.
ES-6 Rubber Sheath Compound for Electrical Insulated Cords and Cables Where Extreme Abrasion Resistance Is Not Required.
ES-7 Fire-Refined Copper for Wrought Products and Alloys.
ES-8 85 Per Cent Magnesia Thermal Insulating Cement.
ES-9 Long Fiber Asbestos Thermal Insulating Cement.
ES-10 Mineral Wool Thermal Insulating Cement.
ES-11 Expanded or Exfoliated Mica Thermal Insulating Cement.
ES-12 Diatomaceous Earth Thermal Insulating Cement, for Use from 600 to 1200 F.
ES-13 Diatomaceous Earth Thermal Insulating Cement, for Use from 1200 to 1900 F.
ES-14 Blanket Thermal Insulation for Building Purposes.
ES-15 Blanket Thermal Insulation for Industrial Purposes.
ES-16 Blanket Thermal Insulation for Refrigeration.
ES-17 Preformed Pipe Covering Thermal Insulation.
ES-18 Preformed Block Thermal Insulation.
ES-19 Structural Board Thermal Insulation.
ES-20 Malleable Iron Flange, Pipe Fittings, and Valve Parts.

Emergency Alternate Provisions in Specifications for[2]

Steel

EA-A 1 Open-Hearth Carbon-Steel Rails (A 1-39).[7]
EA-A 21 Carbon-Steel Axles for Cars and Tenders (A 21-39).[8]
EA-A 25a Wrought Steel Wheels for Electric Railway Service (A 25-41).[9]
EA-A 26 Steel Tires (A 26-39).[6]
EA-A 27 Carbon-Steel Castings for Miscellaneous Industrial Uses (A 27-42).[5]
EA-A 57 Multiple-Wear Wrought Steel Wheels (A 57-39).[7]
EA-A 67 Steel Tie Plates (A 67-33).[7]
EA-A 83 Lap-Welded and Seamless Steel and Lap-Welded Iron Boiler Tubes (A 83-42).[8]
EA-A 87 Carbon-Steel and Alloy-Steel Castings for Railroads (A 87-42).[5]
EA-A 120 Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Ordinary Uses (A 120-42).[8]
EA-A 134 Electric-Fusion-Welded Steel Pipe (Sizes 30 in. and Over) (A 134-42).[8]
EA-A 135 Electric-Resistance-Welded Steel Pipe (A 135-42).[8]
EA-A 139 Electric-Fusion-Welded Steel Pipe (Sizes 8 in. to but not Including 30 in.) (A 139-42).[8]
EA-A 148 Alloy-Steel Castings for Structural Purposes (A 148-42).[5]
EA-A 160 Axle-Steel Bars for Concrete Reinforcement (A 160-39).[7]
EA-A 161 Seamless Low-Carbon and Carbon-Molybdenum Steel Still Tubes for Refinery Service (A 161-40).[8]
EA-A 167 Corrosion-Resisting Chromium-Nickel Steel Sheet, Strip, and Plate (A 167-42).[7]
EA-A 177 High-Strength Corrosion-Resisting Chromium-Nickel Steel Sheet and Strip (A 177-42).[7]
EA-A 178 Electric-Resistance-Welded Steel and Open-Hearth Iron Boiler Tubes (A 178-40).[8]
EA-A 179 Seamless Cold-Drawn Low-Carbon Steel Heat-Exchanger and Condenser Tubes (A 179-42).[8]
EA-A 183 Heat-Treated Carbon- and Alloy-Steel Track Bolts and Nuts (A 183-40 T).[7]
EA-A 186 One-Wear and Two-Wear Wrought Steel Wheels (A 186-39).[7]
EA-A 190 Lightweight and Thin-Sectioned Gray-Iron Castings (A 190-40).[7]
EA-A 192 Seamless Steel Boiler Tubes for High-Pressure Service (A 192-40).[8]
EA-A 194 Carbon and Alloy-Steel Nuts for Bolts for High-Pressure and High-Temperature Service to 1100 F. (A 194-40).[6]
EA-A 199 Seamless Cold-Drawn Intermediate Alloy-Steel Heat-Exchanger and Condenser Tubes (A 199-40).[8]
EA-A 200 Seamless Intermediate Alloy-Steel Still Tubes for Refinery Service (A 200-40).[8]
EA-A 209 Seamless Carbon-Molybdenum Alloy-Steel Boiler and Superheater Tubes (A 209-42).[8]
EA-A 211 Spiral-Welded Steel or Iron Pipe (A 211-40).[8]
EA-A 213 Seamless Alloy-Steel Boiler and Superheater Tubes (A 213-42).[8]
EA-A 214 Electric-Resistance-Welded Steel Heat-Exchanger and Condenser Tubes (A 214-42).[8]
EA-A 215 Carbon-Steel Castings Suitable for Fusion Welding for Miscellaneous Industrial Uses (A 215-41).[5]
EA-A 216 Carbon-Steel Castings Suitable for Fusion Welding for Service up to 850 F. (A 216-42 T).[6]
EA-A 217 Alloy-Steel Castings Suitable for Fusion Welding for Service from 750 to 1100 F. (A 217-42 T).[6]
EA-A 226 Electric-Resistance-Welded Steel Boiler and Superheater Tubes for High-Pressure Service (A 226-40).[8]
EA-A 227 Hard-Drawn Steel Spring Wire (A 227-41).[6]
EA-A 229 Oil-Tempered Steel Spring Wire (A 229-41).[6]
EA-A 230 Carbon-Steel Valve Spring Quality Wire (A 230-41).[6]
EA-A 236 Carbon-Steel Forgings for Locomotives and Cars (A 236-42).[8]
EA-A 238 Alloy-Steel Forgings for Locomotives and Cars (A 238-42).[8]
EA-A 240 Corrosion-Resisting, Chromium and Chromium-Nickel Steel Sheet, Strip, and Plate for Fusion-Welded Unfired Pressure Vessels (A 240-42).[7]
EA-A 241 Hot-Worked High-Carbon Steel Tie Plates (A 241-41).[7]
EA-A 244 Heat-Treated Wrought Steel Wheels (A 244-42).[7]
EA-A 249 Atomic-Hydrogen-Arc-Welded and Electric-Resistance-Welded Alloy-Steel Boiler and Superheater Tubes (A 249-42).[8]
EA-A 250 Electric-Resistance-Welded Carbon-Molybdenum Alloy-Steel Boiler and Superheater Tubes (A 250-41 T).[8]

Non-Ferrous Metals and Alloys

EA-B 23 White Metal Bearing Alloys (Known Commercially as "Babbitt Metal") (B 23-26).[6]
EA-B 30 Copper-Base Alloys in Ingot Form for Sand Castings (B 30-42 T).[7]
EA-B 32 Soft Solder Metal (B 32-40 T).[6]

[1] Available in separate pamphlet form and also published in 1942 Book of Standards.
[2] Available as "pink slips" affixed to each of the separate respective specifications and published in various issues of the ASTM BULLETIN as indicated by footnotes. Complete set to be furnished with respective parts of the 1942 Book of Standards.
[3] December, 1941 ASTM BULLETIN.
[4] January, 1942 ASTM BULLETIN.
[5] March, 1942 ASTM BULLETIN.
[6] May, 1942 ASTM BULLETIN.
[7] August, 1942 ASTM BULLETIN.
[8] October, 1942 ASTM BULLETIN.
[9] December, 1942 ASTM BULLETIN.
[10] To appear in January, 1943 ASTM BULLETIN.

EA-B 60 Castings of the Alloy: Copper 88 per cent, Tin 8 per cent, Zinc 4 per cent (B 60-41).[7]
EA-B 62 Composition Brass or Ounce Metal Castings (B 62-41).[7]
EA-B 85 Aluminum-Base Alloy Die Castings (B 85-42).[8]
EA-B 86a Zinc-Base Alloy Die Castings (B 86-41 T).[9]
EA-B 143 Tin-Bronze and Leaded Tin-Bronze Sand Castings (B 143 - 42 T).[7]
EA-B 144 High-Leaded Tin-Bronze Sand Castings (B 144-42 T).[7]
EA-B 145 Leaded Red Brass and Leaded Semi Red Brass Sand Castings (B 145-42 T).[7]
EA-B 146 Leaded Yellow Brass Sand Castings for General Purposes (B 146-42 T).[7]
EA-B 148 Aluminum-Bronze Sand Castings (B 148-42 T).[7]

"C" and "D" Groups

EA-C 150 Portland Cement (C 150-42).[1]
EA-D 27a Insulated Wire and Cable: Class AO, 30 per cent Hevea Rubber Compound (D 27-41).[6]
EA-D 69 Friction Tape for General Use for Electrical Purposes (D 69-38).[10]
EA-D 119 Rubber Insulating Tape (D 119-38).[10]
EA-D 224 Asphalt Roofing Surfaced with Powdered Talc or Mica (D 224-41 T).[7]
EA-D 249 Asphalt Roofing Surfaced with Coarse Mineral Granules (D 249-42 T).[7]
EA-D 353 Insulated Wire and Cable: Performance Rubber Compound (D 353-41).[6]
EA-D 375 Test for Asbestos Roving for Electrical Purposes (D 375-42). (Specifications and Methods)[7]
EA-D 455 Milled Toilet Soap (D 455-39).[6]
EA-D 469 Insulated Wire and Cable: Heat-Resisting Rubber Compound (D 469-41).[6]
EA-D 499 White Floating Toilet Soap (D 499-39).[6]
EA-D 524 Test for Carbon Residue of Petroleum Products (Ramsbottom Carbon Residue) (D 524-42).[8]
EA-D 532 Rubber Sheath Compound for Electrical Insulated Cords and Cables (D 532-39 T).[5]
EA-D 533 Built Soap, Powdered (D 533-41).[6]
EA-D 535 Palm Oil Solid Soap (Type A, Pure; Type B, Blended) (D 535-41).[6]
EA-D 536 Palm Oil Chip Soap (Type A, Pure; Type B, Blended) (D 536-42).[6]
EA-D 574 Insulated Wire and Cable: Ozone-Resistant Type Insulation) (D 574-40 T).[6]
EA-D 592 Olive Oil Solid Soap (Type A, Pure; Type B, Blended) (D 592-42).[6]
EA-D 593 Salt-Water Soap (D 593-42).[6]
EA-D 607 Mica Pigment (D 607-42).[8]
EA-D 630 Olive Oil Chip Soap (Type A, Pure; Type B, Blended) (D 630-42).[6]

NEW MEMBERS TO DECEMBER 1, 1942

The following 24 members were elected from October 16 to December 1, 1942:

Chicago District

ELGIN, JOLIET & EASTERN RAILWAY CO., F. H. Masters, Chief Engineer, Joliet Building, Joliet, Ill.

GIBBS AND CO., THOMAS B., DIVISION OF THE GEORGE W. BORG CORP., Samuel Dinerstein, Metallurgist, Delavan, Wis.

SMITH, HOWARD A., Chief Metallurgist, Tubular Alloy Steel Corp., Box 508, Gary, Ind.

New York District

AIRCRAFT PARTS DEVELOPMENT CORP., Jack Sandler, Chief Plastics Engineer, 409 Broad St., Summit, N. J.

DICALITE CO., THE, C. A. Frankenhoff, President, 120 Wall St., New York, N. Y.

MCILWAIN, KNOX, Engineer, Hazeltine Service Corp., 58-25 Little Neck Parkway, Little Neck, L. I., N. Y.

Northern California District

HARDING, JAMES A., Manufacturing Engineer, Marchant Calculating Machine Co., Oakland, Calif. For mail: 2122 Lakeshore Ave., Oakland, Calif.

Philadelphia District

BERLINER CO., JOSEPH, Jesse Berliner, Secretary and Treasurer, Lewis and Ashland Sts., Philadelphia, Pa.

TEXTILE MACHINE WORKS, H. P. Good, Foundry Superintendent, Box 1382, Reading, Pa.

Southern California District

GILMORE OIL CO., Orson V. Saxton, Chief Chemist, 2423 E. Twenty-eighth St., Los Angeles, Calif.

KAISER CO., INC., IRON AND STEEL DIVISION, John F. Drake, Chief Chemist, Box 201, Fontana, Calif.

ANDERSON, R. V., Engineer in Charge of General Testing Laboratory, California Shipbuilding Corp., Terminal Island, Calif. For mail: 1137 S. Fourth St., Alhambra, Calif.

U. S. and Possessions

Other than A.S.T.M. Districts

FOSTORIA PRESSED STEEL CORP., THE, C. W. McDaniel, Vice-President, Fostoria, Ohio.

BEAUMONT MANUFACTURING CO., T. I. Dashiell, Assistant Treasurer, Spartanburg, S. C.

NATIONAL SUPPLY CO., SUPERIOR ENGINE DIVISION, K. G. Presser, Chief Chemist and Metallurgist, 1401 Sheridan Ave., Springfield, Ohio.

AUMENT, RICHARD P., Laboratory Manager, American Box Board Co., Grand Rapids, Mich.

HACKETT, ROBERT P., Vice-President, Nichols and Co., Inc., 140 Federal St., Boston, Mass.

HARRIS, RUSSELL H., Wool Buyer, American Woolen Co., 38 Chauncy St., Boston, Mass.

HUGHES, WILLIAM B., Chemist, Oklahoma State Highway Commission, Oklahoma City, Okla. For mail: 2735 N. W. Twenty-first St., Oklahoma City, Okla. [J]*

SEYDEL, JOHN R., Partner, Seydel-Woolley and Co., Box 36, Station D, Atlanta, Ga. [J]

WILLIAMS, JEAN R., Chief Engineer, Markey Machinery Co., Inc., 85 Horton St., Seattle, Wash.

Other than U. S. and Its Possessions

CEMENTOS HIDALGO, S. C. L., Basilio Morales, Interventor, Hidalgo, N. L., Mexico.

DE SOLA, FRANCISCO, Partner, H. de Sola e Hijos, San Salvador, El Salvador.

MEXICO DIRECCION GENERAL DE CONSTRUCCION DE FERROCARRILES, P. Martínez Tornel, Director General, Plaza de la Reforma No. 2, Mexico, D. F., Mexico.

* [J]—Denotes Junior Member.

DECEMBER 1942
NO. 119

ASTM Bulletin

American Society for Testing Materials

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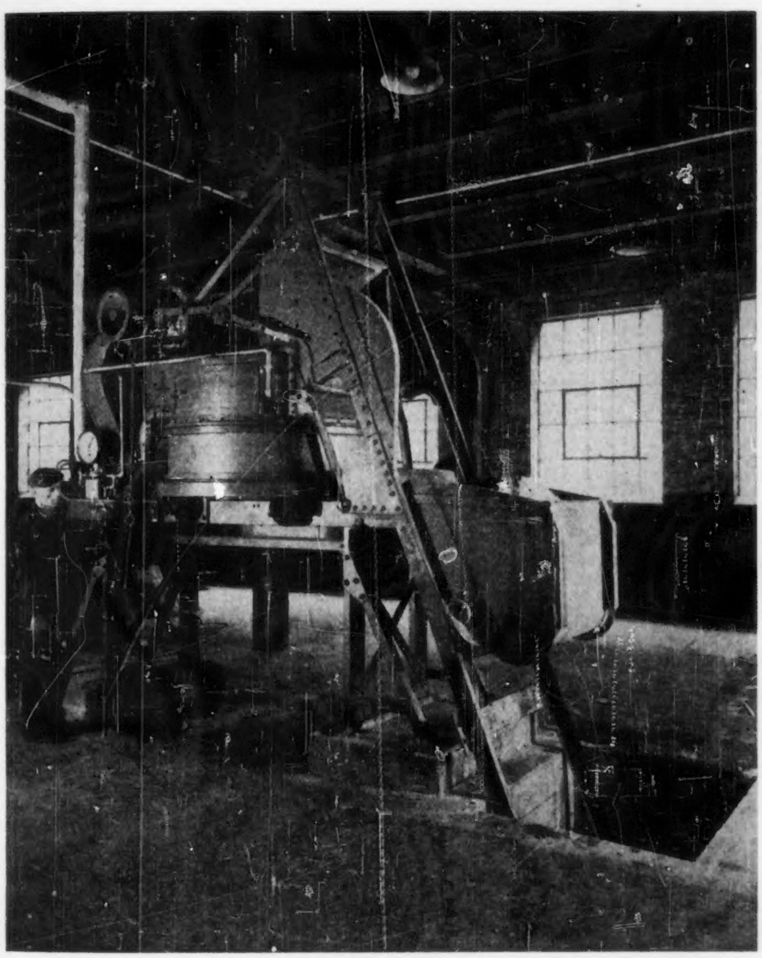

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James K. Walker
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